MARCH 1951 — FIFTY-SEVENTH YEAR

MACHINERY

Editor
CHARLES O. HERB

Associate Editors
FREEMAN C. DUSTON
CHARLES H. WICK
GEORGE H. DeGROAT

Book Editor
HOLBROOK L. HORTON

Consulting Editor
ERIK OBERG

•

Published Monthly By
THE INDUSTRIAL PRESS
Lafayette St., New York 13, N. Y.

ROBERT B. LUCHARS
President

EDGAR A. BECKER
Vice-President and Treasurer

HAROLD L. GRAY
Secretary and Publishing Manager

•

Advertising Representatives
LOUIS PELLETIER
WALTER E. ROBINSON
DWIGHT COOK
Lafayette St., New York 13, N. Y.

GEORGE H. BUEHLER
228 N. LaSalle St., Chicago 1, Ill.

BOYCE TOPE
58 Maccabees Bldg., Detroit 2, Mich.

DON HARWAY & COMPANY
09 W. Eighth St., Los Angeles 17, Calif.

Subscription rates: United States and Canada, one year, $4; two years, $7; three years, $8; foreign countries, $7 a year. Single copies, 40 cents. Changes in address must be received by the fifteenth of the month to be effective for the next issue. Send old as well as new address. Entered as second-class mail matter, September, 1894, at the Post Office, New York, N. Y., under the Act of March 3, 1879. Printed in the United States of America.

British Address:
National House, West St.
Brighton 1, England

Total Distribution
for February, 23,625

MACHINERY

VOLUME 57 **MARCH, 1951** **NUMBER 7**

The Monthly Magazine of Engineering and Production in the Manufacture of Metal Products

SHOP PRACTICE

How Britain Builds Tanks ... 143
Buick Uses Carbide to Broach at 120 Feet per Minute *By Stanley J. White* 152
Revacycle Process Increases Chrysler's Gear Production *By Charles H. Wick* 163
Methods of Heating Laminated Plastics for Postforming *By William I. Beach* 170
Deep-Drawing Aluminum Parts with Low-Cost Dies *By Emilio Andreola* 173
Brazing and Bronze Welding in Maintenance and Manufacture *By George H. DeGroat* 180
Recent Developments in Large Closed-Die Forging *By E. O. Dixon* 184
Arc-Welding Stainless Steel without Columbium *By Richard K. Lee* 191

MACHINE AND TOOL DESIGN

Designing Hopper Feeds for Square and Hexagonal Nuts *By J. R. Paquin* 158
Spindle for Grinding Punches Having Various Sized Threads *By L. Kasper* 193
Milling Fixture with Adjustable Holding Feature *By Robert Mawson* 194
Jig for Drilling Spanner-Wrench Holes *By Robert W. Newton* 194
Clamp for Piercing Die *By F. A. Adams* 196
Lathe Tailstock Adapter for Turning Spherical Surfaces *By John Homewood* 197
Simple Ejector for Fixtures *By F. A. Adams* 197
American Standard Plain Washers (Data Shet) ... 245

MANAGEMENT PROBLEMS

Keeping Up with Washington *By Loring F. Overman* 139
Should Skilled Mechanics be Deferred? *By Charles O. Herb* 141
Tool Engineers to Hold Annual Meeting in New York ... 190
The Sales Engineer and His Problems *By Bernard Lester* 202

DEPARTMENTS

Keeping up with Washington ... 139
Engineering News ... 168
Tool Engineering Ideas ... 193
Ideas for Shop and Drafting-Room ... 197
Questions and Answers ... 198
The Sales Engineer ... 202
The Latest in Shop Equipment ... 204
Between Grinds ... 233
New Catalogues ... 235
News of the Industry ... 238
Data Sheet ... 245

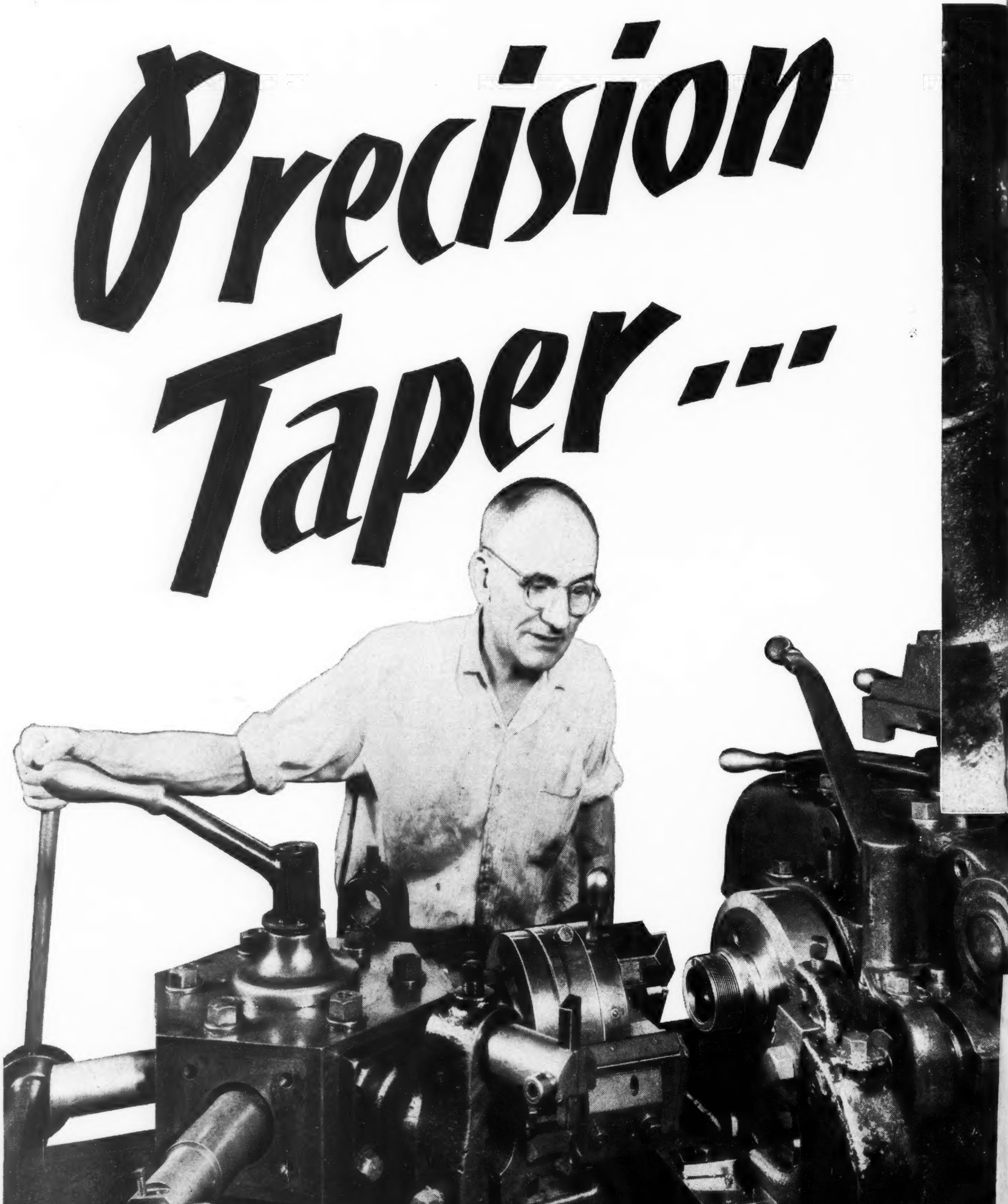
Product Index
347-391

Advertisers Index
393-394

SOCIETY of BUSINESS MAGAZINE EDITORS

LANDMATIC DIE HEAD

Precision Taper...



LANDIS *Machine* COMPANY · WAYNESBORO PENNSYLVANIA

Should Skilled Mechanics be Deferred?

MASS production of metal parts is made possible by equipping machines with special tools and dies so that work can be turned out by comparatively unskilled employes—men and women who can be quickly trained to load and unload work fixtures and apply gaging devices. Obviously, therefore, the speed at which production can get under way for national defense depends greatly upon the early availability of the tools, dies, and machines required for turning out war materiel.

Tools and dies, especially, will be a bottleneck if provision is not made to insure an adequate supply of skilled men for the more than 3000 tool and die shops in this country and for the tool-rooms of large manufacturing plants. Most of the tools and dies used for munitions production in the last war have been scrapped or become obsolete, and must be replaced. Skilled men are required for this work, and the supply will be wholly inadequate if the young tool and die makers are drafted at this time into the Armed Forces. Already the reservoir of unemployed men skilled in these trades has been depleted in various sections of the country. With shops now working fifty hours or more a week and expected to double their output before the middle of the year, this shortage of skilled help becomes a serious matter.

It may be argued that most of the boys likely to be drafted are merely apprentices. But even if a boy has had only two years of training, it is going to take that long to train a replacement. Besides, many boys are full-fledged toolmakers by the time they are twenty-one years of age.

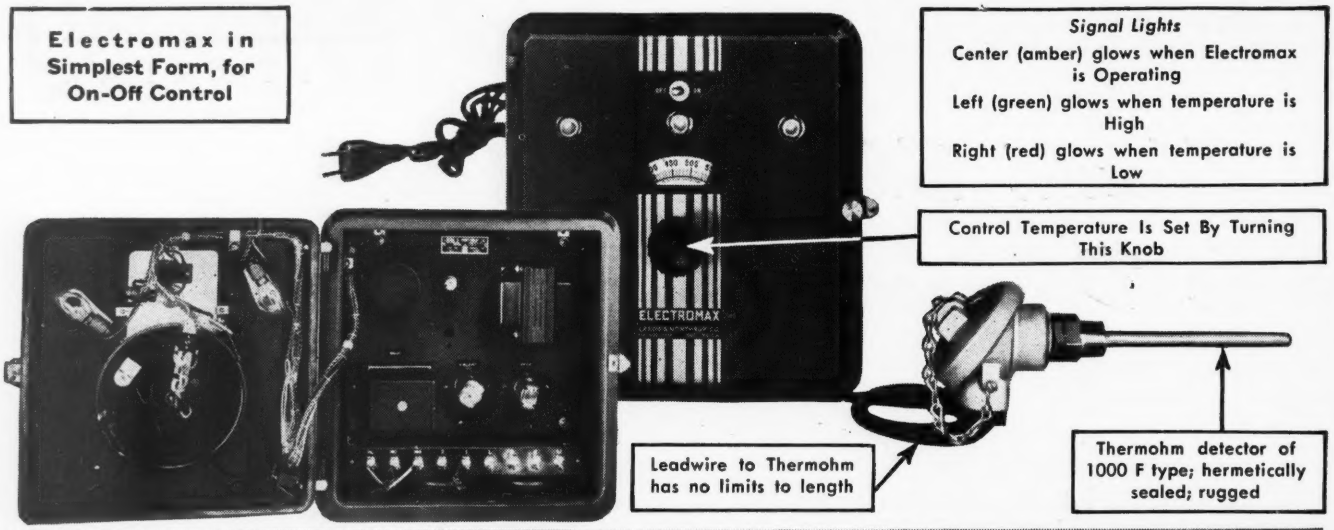
Unfortunately, because of the slackness in the tool and die industry during the post-war years, it was not economically possible to train the number of apprentices required to replace the men lost by old age and death, so that there are now fewer men skilled in tool and die making than at the beginning of the last war.

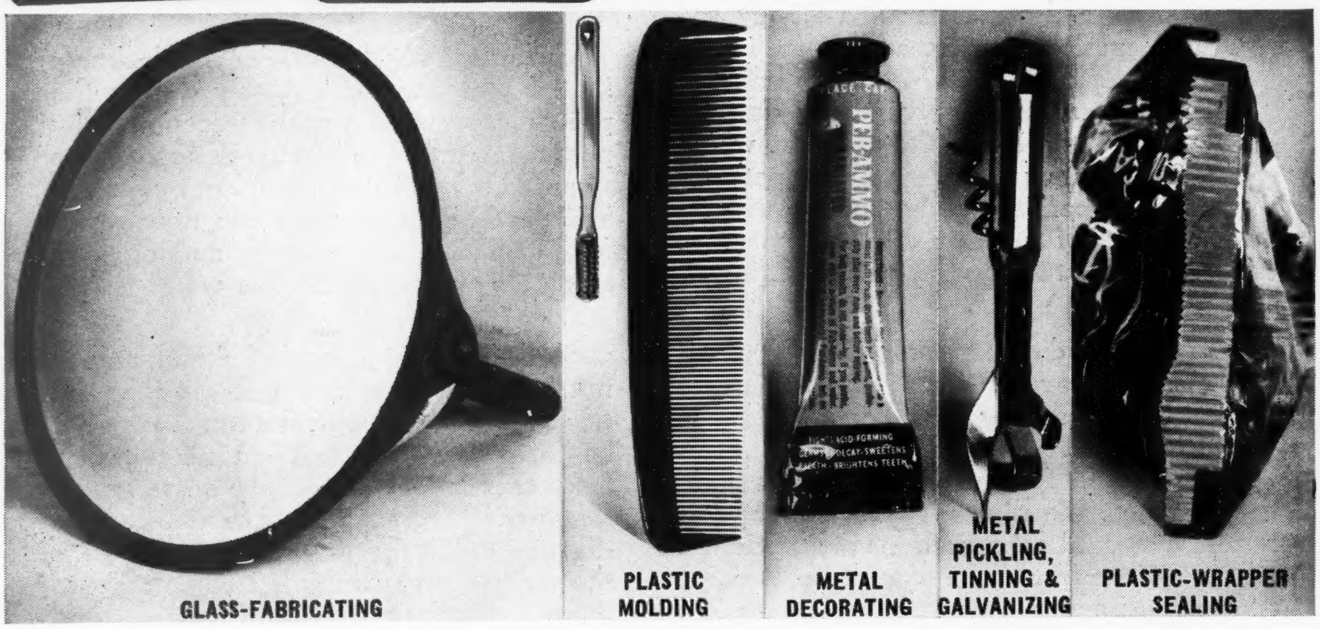
Skilled and partially skilled men should not be taken from tool and die shops at this time, even though the shops may not be doing war work to their full capacity, because most of them will be operating on that basis before long. The question of drafting or not drafting men necessary for the production effort is left completely to the discretion of local draft boards, and there is no national office to which appeals can be made for relief from manpower depletion of shops. Personnel of the local draft boards are seldom versed in manufacturing techniques, and therefore are not qualified to judge the worthiness of requests for special consideration of mechanically trained men.

There is more to fighting a war than carrying a gun. Our national effort may be crippled at the start if insufficient attention is paid to the matter of deferring skilled men from active service, at least until after industrial plants have been tooled up for the job ahead.

Charles O. Herb

EDITOR





PROTECT PRODUCTION WITH ELECTROMAX CONTROL

ELECTROMAX CONTROLLERS give modern *electronic* regulation to thousands of important manufacturing processes. They exactly fill the bill for non-recording controllers of outstanding dependability.

Electromax has the sensitivity, accuracy and dependability of its big brother Speedomax Recording Controller. Likewise, it is not affected by vibration or building tremors—can even be mounted on the frame of a molding press. The instrument needs almost no attention, because it has only one moving part—a covered, plug-in type relay. There's usually no need to open its door for months at a time.

You can specify any one of 3 types of control action:

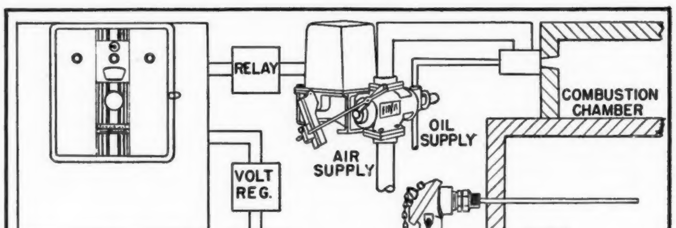
1. On-Off or 2-position Control
2. Proportioning, automatic reset and rate (D.A.T.) Control
3. Proportioning and manual reset (P.A.T.) Control

For further information, write our nearest office, or 4921 Stenton Ave., Philadelphia 44, Pa.

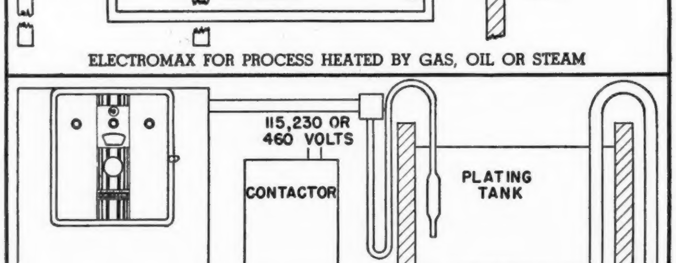
MEASURING INSTRUMENTS · TELEMETERS · AUTOMATIC CONTROLS · HEAT-TREATING FURNACES

LEEDS & NORTHRUP CO.

Jrl. Ad ND47(1)



ELECTROMAX FOR PROCESS HEATED BY GAS, OIL OR STEAM



ELECTROMAX FOR PROCESS HEATED BY ELECTRICITY

MACHINERY

Vol. 57 MARCH, 1951 No. 7

HOW BRITAIN BUILDS TANKS

Fabricating Hulls and Machining Turrets for the 50-Ton Centurion Tank—Britain's Latest Vehicle of Its Type, Now in Quantity Production at the Royal Ordnance Factory, Leeds, England

THE 50-ton Centurion tank—Britain's latest fighting vehicle of its type—is considered to be of the most advanced design in service. The Centurion, which is now the standard tank of the Royal Armoured Corps, was developed by the Fighting Vehicle Design Establishment of the Ministry of Supply in collaboration with Vickers-Armstrong, Ltd., and the first prototypes were produced just before the end of the war in 1945. Since then, two new versions of the tank have been developed that embody considerable advances in design. At the present time, the tank is being made both by the Ministry of Supply at the Royal Ordnance factory, Leeds, and by Vickers-Armstrong, Ltd.

The ordnance factory in Leeds, which covers fourteen acres, came into operation early in 1940, and was originally employed for the manufacture of light- and medium-caliber guns. In 1945, however, a start was made on the re-equipment of the factory for tank production, and eighteen months later the first Centurion tank was completed. This change-over necessitated clearing practically all the original plant and installing new machines and equipment. Although some of this equipment is of special design, it has been found possible, by interesting adaptations, to employ standard types of machine tools extensively, particularly for the heavy components, thus insuring maximum flexibility from the point of view of both design and production.

In addition to the section in which welded fab-

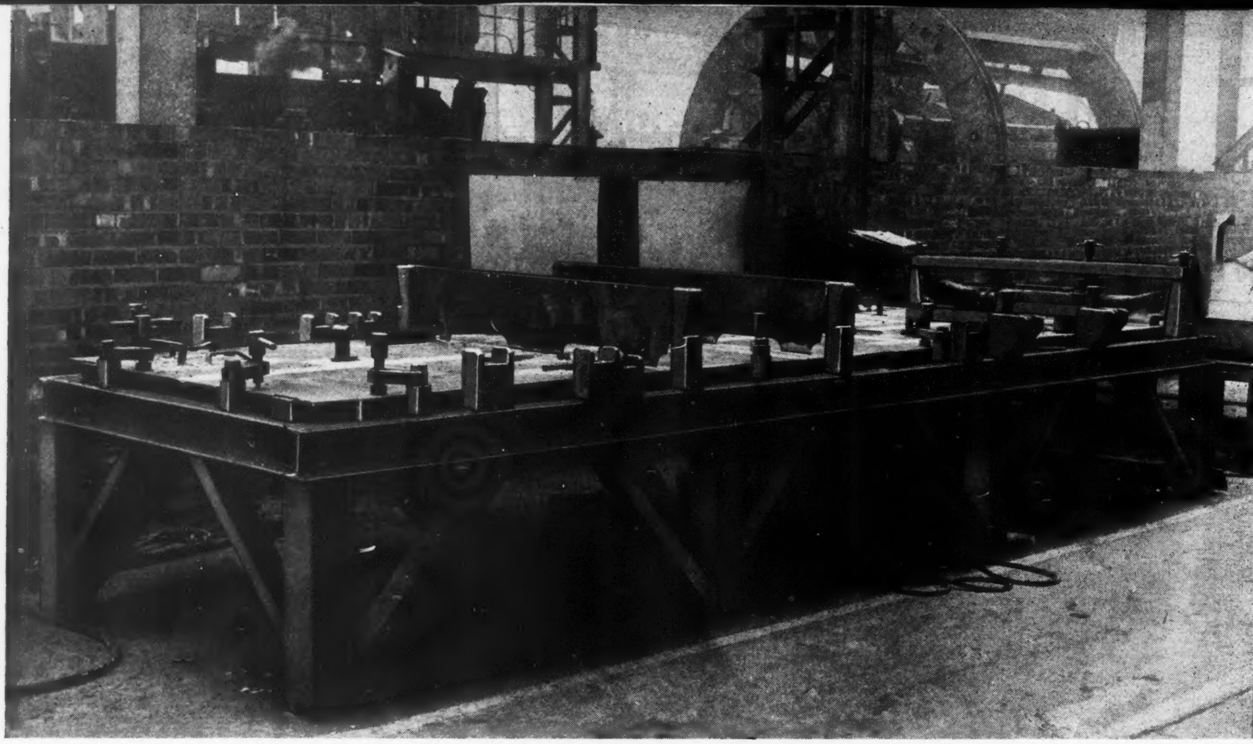


Fig. 1. Floor supports and the engine cross-member are the principal parts added to the floor plate in this table type welding jig

rication is undertaken, heavy machine shops, and assembly lines, there is an extensive light and medium machine shop. Some of the more specialized aspects of this type of production are considered in this article.

The Centurion tank is powered by a Meteor twelve-cylinder, V-type gasoline engine of 635 brake horsepower, which is an adaptation of the well-known Rolls-Royce Merlin engine. The combined gear-box and steering unit is of the triple-differential type. The main armament comprises a 20-pounder gun, and under suitable conditions, the tank has a speed of twenty-one miles per hour.

The gear-box is a totally enclosed unit housed in the rear compartment of the hull, the brake drums being mounted outside the casing. From the output shaft the drive is transmitted to the duplex track sprockets through double-reduction spur gearing carried in casings that are incorporated in the hull side plates. The engine is mounted in the next compartment, and is coupled to the gear-box by a right-angle drive.

The twin radiators for the engine are mounted so as to pivot above the gear-box compartment to give access to the box. Also housed in the main engine compartment is an 8-H.P. engine which drives an electrical generator supplying power for such functions as turret rotation, gun elevation, battery charging, lighting, and lowering the driver's seat when the access doors in the hull are to be closed.

The hull is wholly of welded construction, and because of the nature of the duties of a heavy armored fighting vehicle, problems arise in production not usually encountered in other types of welded steel fabrication. The greater proportion of the material employed is thick armor plate, and very heavy fillets are necessary to give adequate strength.

Arc-welding with alternating-current equipment is exclusively employed, the sets in use being generally of 300 and 600 amperes capacity. The welding rods are of the austenitic type and of heavy gages—up to 3/8 inch diameter. All welding manipulators and jigs employed on the Centurion are so arranged as to permit horizontal positioning of the various joints of an assembly, so that gravity welding, with a small number of passes, can be carried out.

The hull is composed essentially of two side members of 2-inch thick armor plate; front and rear of 3-inch thick armor assemblies; a 1 1/8-inch thick armored roof plate; and a 5/8-inch thick mild steel bottom plate. The side plates, as well as the components of the front and rear armor, and the roof plate are supplied to the factory already machined to shape from an outside source, their production involving the use of large-scale heat-treatment equipment.

Before the main hull members are welded together, a considerable amount of preliminary work is performed on them, including drilling, tapping, and facing operations, followed by the welding in place of various lugs, brackets, studs, and facing strips. A point of interest concerning inspection is that all tapped holes are individually checked by screw plug gages to insure that no troubles will occur in the assembly shop or in servicing.

Fig. 2. Side armor includes (right) final-drive housing brackets welded to two plates, and (left) welded facing strips for wheel suspension brackets

The table type welding jig for the floor-plate assembly is shown in Fig. 1 with a completed unit in position. The main parts added to the floor plate in this jig are the floor supports and the engine cross-member, at the rear. The principal component welded to the side plates at the preliminary stage is a steel casting seen at *A*, Fig. 2, which forms the attachment bracket for the final drive housing.

For this operation, a right-hand and a left-hand plate are clamped together, as shown, to provide support for each other and prevent any distortion that might occur due to localized heating during welding. The steel castings are machined on the joint faces, and each is held in position on the side plate by means of two bolts. After one casting has been welded, the plates are turned over by crane and the other casting welded to its plate.

The plates are then separated and three sets of mild-steel facing strips are bolted in position and welded. These facing strips, one set of which is seen on the plate at the left in Fig. 2, are subsequently machined, and provide for mounting three suspension arm brackets, each of which carries a pair of solid rubber-tired track wheels.

To obtain datum lines for subsequent operations, the side plates are next placed on a surface plate and marked out to indicate certain machined faces and center lines. Finally, before they are assembled to the hull, a number of small fittings are welded on, using a large table type jig for locating purposes. Numerous studs are also added, using Nelson stud-welding technique.

In view of the large amount of heavy welding of main and sub assemblies involved in the production of the Centurion tank, special attention has been paid to the provision of welding jigs and manipulators capable of producing work to the required high standard of accuracy and facilitating handling so that flow-line production can be maintained. It is the practice, for example, for all main and sub-assembly welded work, to provide duplicate jigs, so that while actual welding is being carried out in one jig a set of parts can be assembled and lined up in the other.

Further examples of sub-assembly welded work are seen in Figs. 3 and 4. The combined jig and manipulator, Fig. 3, is employed for the nose armor, a complete sub-assembly of which is seen at *K* in Fig. 5, ready for welding into position on the tank's hull. The two main members *B* and *C*, Fig. 3, of 3-inch thick armor plate, are clamped by cross-members *D* and *E* to the locating faces of the jig. For positioning purposes, and to provide additional stiffness, two thick gusset plates *F* and *G* are fitted to the nose armor, the gussets being bolted to temporary lugs welded to the armor plates as seen at *H*.

The hand-operated worm-geared manipulator is mounted over a pit. The main outer frame and the inner jig frame can be swiveled through 360-degrees on axes at right angles to each other, so that gravity welding can be carried out, as previously explained. The various angular positions required are determined by an index-plate and plunger. The size of the main fillet on the nose armor is 1 inch, and a 3/8-inch diameter electrode is employed for the final pass.

The other welding jig, shown in Fig. 4, is for

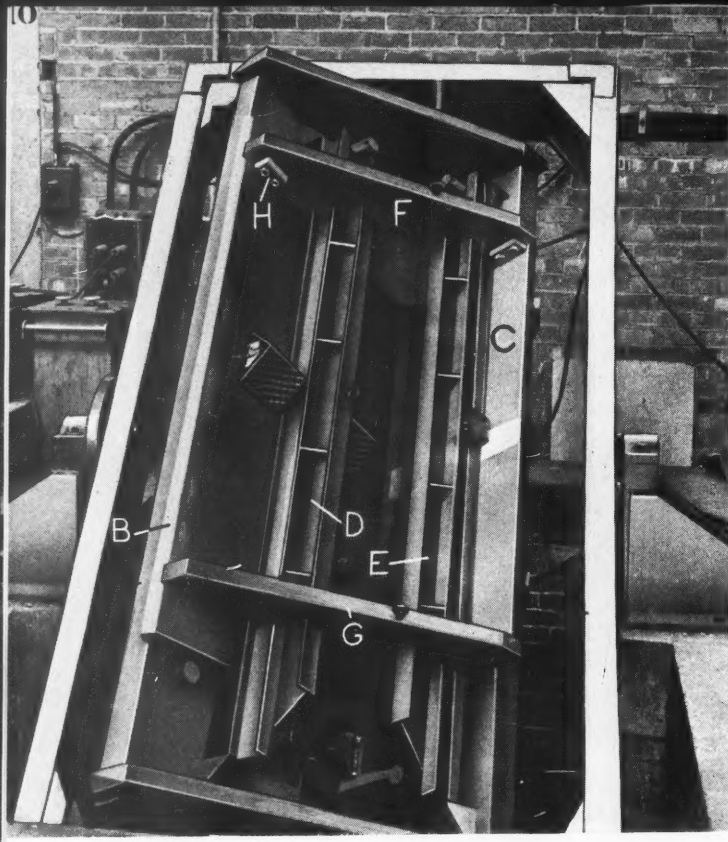
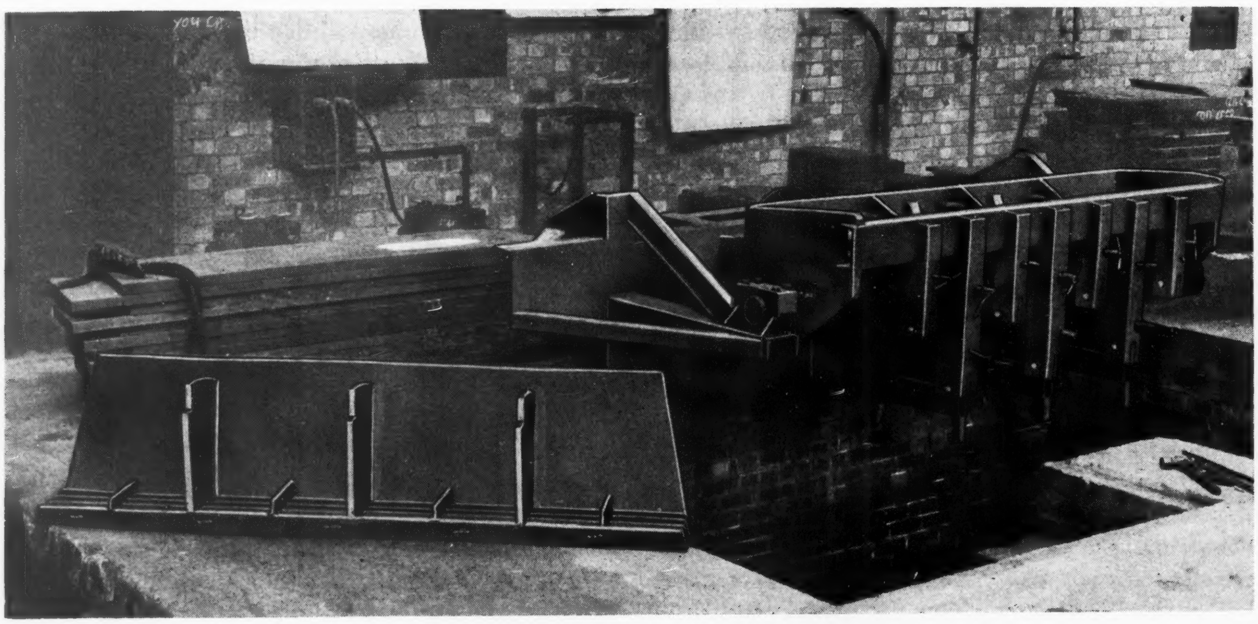


Fig. 3. Manipulator and jig for welded nose-armor assembly. Main outer frame and inner jig frame can both be swiveled 360 degrees

Fig. 4. (Below) Welding manipulator for the radiator louver, which is mounted over a pit and has movement through 360 degrees about two axes at right angles



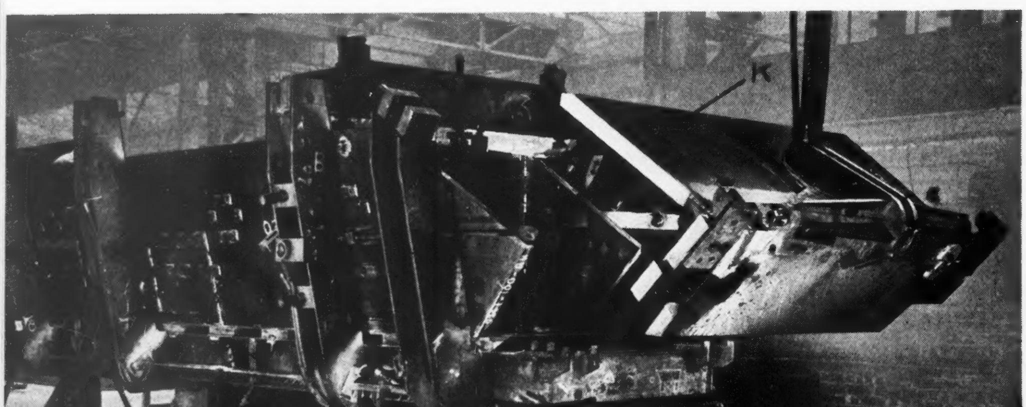


Fig. 5. Bogie welding jig for the tank hull runs on a railway track. Nose-armor sub-assembly (K) is shown being moved into position

the radiator louver assembly, a completed part being seen at the left. Here, again, the manipulator is mounted over a pit and has movement through 360 degrees on two axes at right angles to each other. Welded work is generally inspected before the parts are removed from the jigs.

As the main welded assembly of the Centurion tank hull is about 25 feet long and weighs nearly 15 tons, the handling equipment and jigs installed for dealing with this work are particularly massive. The tanks are produced by flow-line methods, and the production technique developed is of special interest.

Bogie type jigs, as seen in Fig. 5, that run on standard-gage railway tracks are first employed. At the initial stage, fitters line up and clamp in position the side plates, nose and rear armor, roof plate, bottom plate, and several other major components. In Fig. 5, this operation is seen in progress, and the nose armor is being moved into position by the crane. The lifting attachment provided for this component is so designed that, by a vertical lift, the part is held at substantially the correct angle for moving it horizontally into position on the hull. Devices of this nature, and the provision of lifting eyes at suitable points on the work, are prominent throughout the whole production sequence.

A certain amount of tack-welding is performed as soon as the assembly is completed in the jig, and the jig is then pulled along the rails, into the large power-driven rotary type manipulator seen in Fig. 6. These manipulators, which are 24 feet in diameter, are actually standard type railway-car tippers adapted for the purpose, and they provide a very convenient means of handling the work at this stage.

Here further tack-welds are made, together with some of the main welds. For example, welds are made between the floor plate and the side plates, so that the hull is in a self-supporting condition, permitting ready removal from the jig. When the jig has been drawn out of the rotary manipulator upon completion of this welding, the clamps are released and the hull is transferred by crane along the production line to the universal manipulator seen in Figs. 7 and 8, two of which are installed.

The hull is carried at the nose and rear between trunnions that provide for rotation through 360 degrees, while the trunnion brackets, themselves, are fixed to a platform mounted transversely on horizontal trunnions that permit movement to any angle, from the horizontal to the vertical in either a clockwise or a counter-clockwise direction. The trunnion at the nose end contains a single cross-member which passes through the front lifting eyes of the hull, while at the rear, a double yoke member is attached to four eyes on the hull.

The two rotating motions are obtained by means of individual 10-H.P. electric motors through reduction gearing, and the manipulator is controlled from the elevated platform seen at the rear in Fig. 8. The main platform of the manipulator is 38 feet long, and it is mounted over a deep pit. Safety precautions for the operators include nets near the bottom of the pit. The steps running the length of the platform have pivoted treads which are mechanically linked to the rotating mechanism, so that as the platform moves from a vertical to a horizontal position, the treads flatten out to form a catwalk.

Prior to welding, the hull is preheated at se-

Fig. 6. Rotary welding manipulator into which the bogie jig, Fig. 5, is loaded for the initial welding operations on the tank hull

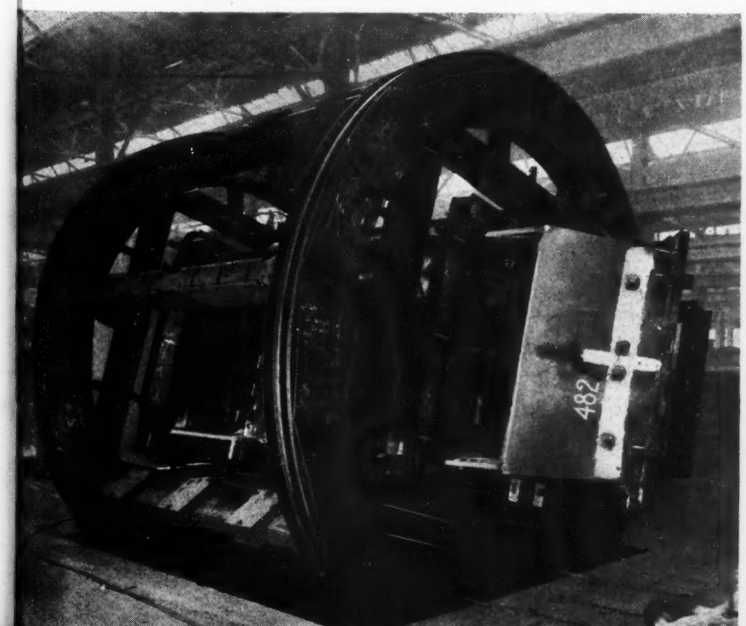
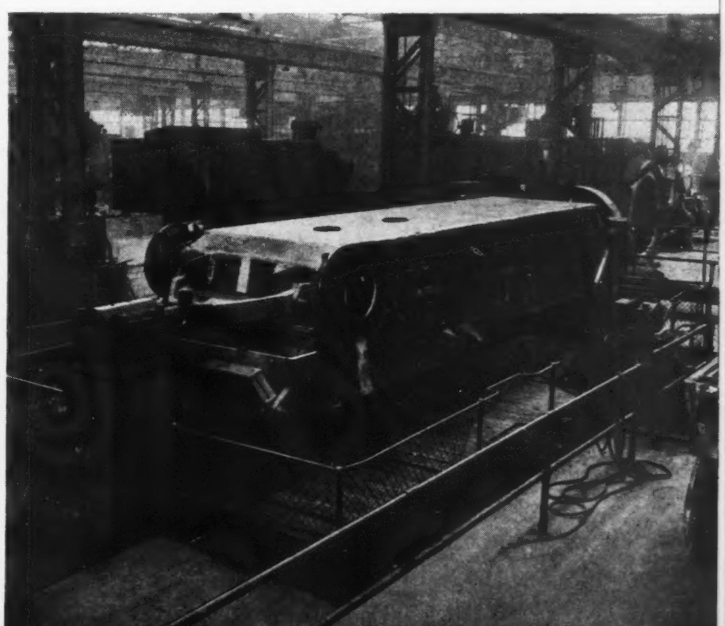


Fig. 7. Universal manipulator for main welding of tank hull. The hull is carried between trunnions, supported on a trunnion platform



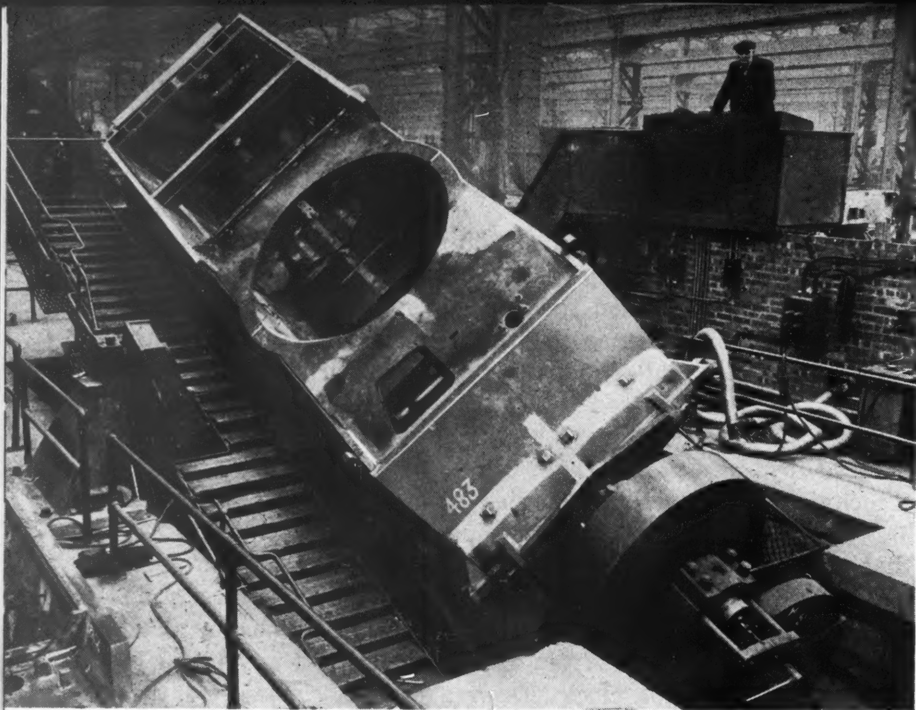


Fig. 8. Another view of universal manipulator seen in Fig. 7. The steps have pivoted treads that are linked to the rotating mechanism

lected points by means of a large portable torch using oxygen and propane gas. From the universal manipulator, the hull is again loaded on a bogie jig and transferred to one of the rotary manipulators for completing certain final details.

Machining Operations on the Tank Hull

Three of the major machining operations on the hull that are of particular interest are illustrated in Figs. 9, 10, and 11, the work comprising boring and facing the roof plate to accommodate the turret; milling, boring, and facing the final-drive housing brackets; and milling the suspension bracket facing strips. These operations illustrate the manner in which heavy workpieces of awkward shape can be machined on a production basis, using standard types of machine tools or special equipment of relatively light and simple design.

After certain center lines and datum lines have been marked off, the hull is loaded on a bogie jig, which runs on rails laid for the full length of the production lines. The hull rests on three screw jacks, which provide for leveling, and is held down by two turnbuckle fastenings at each end, as seen at *L*, Fig. 9. The lengthwise position is determined by an adjusting screw *M* at each end, while the transverse position is governed by two adjusting screws at each side, as seen more clearly at *N*, Fig. 11. For each of the three machining operations to which reference has been made, the jig, when it reaches the correct position along the line, is lifted by crane and bolted to a set of four stools, shown at *P*, Fig. 9, with the wheels clear of the rails.

Boring and facing of the roof plate for the turret is carried out on the special bridge type machine seen in Fig. 9. This machine has a large-diameter cutter-head *R*, which rotates on a vertical axis and is provided with two diametrically opposed cutter-holders. One of the cutters has an automatic feed, operated at each revolution of the head, while the other, which is employed for boring, has a hand-operated feed. The diameter of the hole bored is 76.395 inches, and the cutter-head rotates at about 9 R.P.M. The tools employed have high-speed steel welded tips.

In Fig. 10 is shown the set-up for milling the joint face and boring and facing the final-drive housing brackets. In this instance, to provide additional rigidity, screw jacks are placed under the extreme head of the bogie jig, where machining takes place. The right- and left-hand brackets on the hull are bored at the same set-up, the two traveling-column horizontal milling and boring machines employed being arranged in shallow pits at each side of the track.

To set the spindles of the boring machines in line, two mandrels are employed, one in each spindle, and the columns are adjusted along their bases until a sleeve can be moved freely over the mandrels. In performing the actual machining operations, the vertical and horizontal movements of the spindle are controlled with reference to scales on the machine bed and column. High-speed steel tools are employed, and the 18.250-inch diameter bore is held to a tolerance of $\pm$ 0.005 inch.

Two traveling-column horizontal milling and boring machines, arranged in a similar manner, are employed for milling the suspension bracket facing strips at three positions on each side of the hull. Here, however, the operation is performed on one side at a time, since the sides of the hull are sloping and the bogie jig requires to be tilted to an angle of 12 degrees to the horizontal, as seen in Fig. 11.

The support stools employed rest on steel shoes incorporated in the foundation, and when one side of the hull has been machined, the jig is lifted and the position of the stools changed so that the opposite side is presented at the correct angle for facing by the other machine. The angle of tilt is checked by a clinometer placed on the previously milled final-drive bracket.

The 10-inch diameter milling cutter employed has inserted teeth tipped with tungsten carbide, and the cutting speed is 80 feet per minute. The feed for roughing is 6 inches per minute, and for finishing, 8 inches per minute. Although the facing strips are of mild steel, this operation involves removal also of austenitic weld metal, and, therefore, speeds and feeds consistent with the most economical tool life were chosen.

Also of interest among the machining operations is the method of drilling fifty-two holes in the hull roof plate for attachment of the fixed bearing ring for the turret. A special radial drilling machine is employed for this work, which comprises an arm, a column, and a circular base incorporating the drill guide bushings. The machine is lowered bodily by crane on the top of the hull, and the base has a locator that fits in the bore of the roof plate.

The same method, Fig. 12, is employed for drilling the holes in the turret for attaching the other part of the bearing ring. The machine is positioned radially by means of reference marks. Another radial drilling machine incorporating a jig base is also used for drilling and tapping operations on the turret roof plate.

To meet service conditions, the hull requires to be watertight. Therefore, after completion of the machining operations and some final fitting and detail welding work, a water test is carried out. The various apertures in the bottom plate and the sides are sealed by cover plates, and the hull is lowered by a crane into a water tank until immersed within a few inches of the roof plate, so that any leaks can be observed. After passing this test, the hull is ready for painting and transfer to the assembly line in an adjacent building.

Turret-Machining Operations Present Special Problems

The turret is a massive armor steel casting which presents a number of awkward machining problems. The nature of the material, which, of necessity, is exceedingly tough, causes heavy wear and tear on cutting tools. While tungsten carbide is employed wherever practicable, high-speed steel has been found preferable in many instances because of the interrupted cuts required. Furthermore, the amount of metal to be removed may vary considerably, and differences in hardness between one casting and another and between different parts of the same casting are also encountered.

Operations on the turret of particular importance are the boring of the trunnion holes and the aperture for the mantel which carries the barrel and entire breech and recoil mechanism of the gun. In boring the trunnion holes,

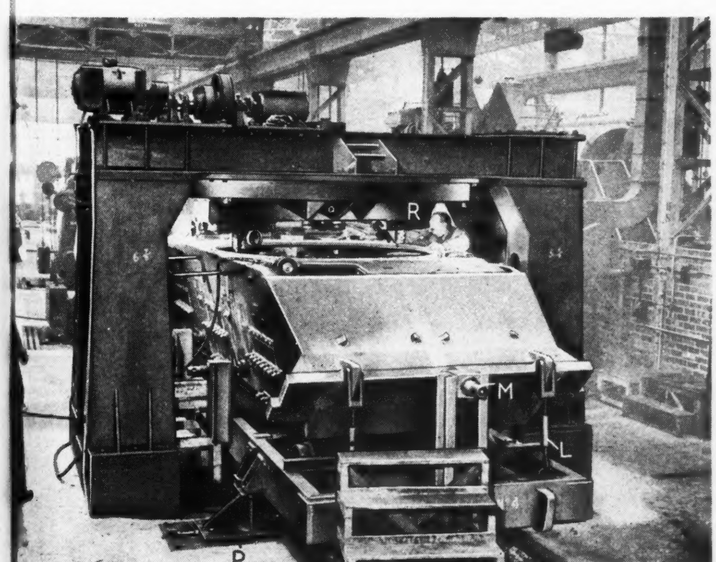


Fig. 9. Bridge type machine used for boring and facing hull roof plate to accommodate turret. Large cutter-head is seen at (R)

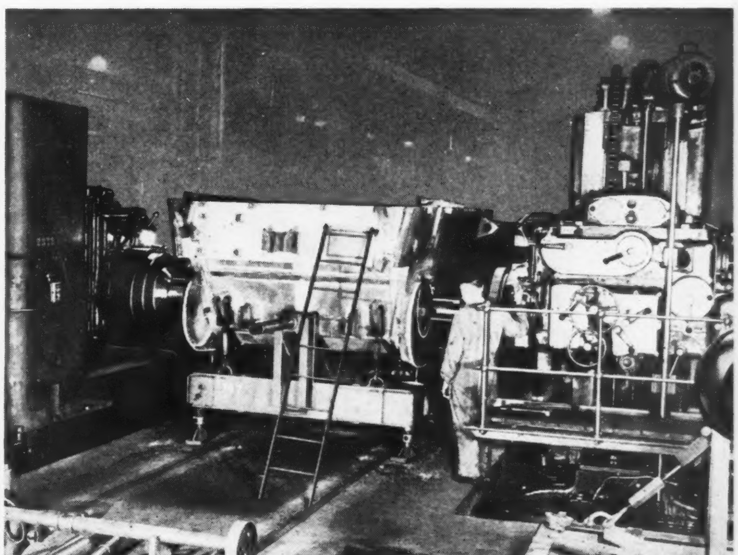


Fig. 10. Final-drive housing brackets are bored, faced, and milled by means of two standard horizontal boring machines

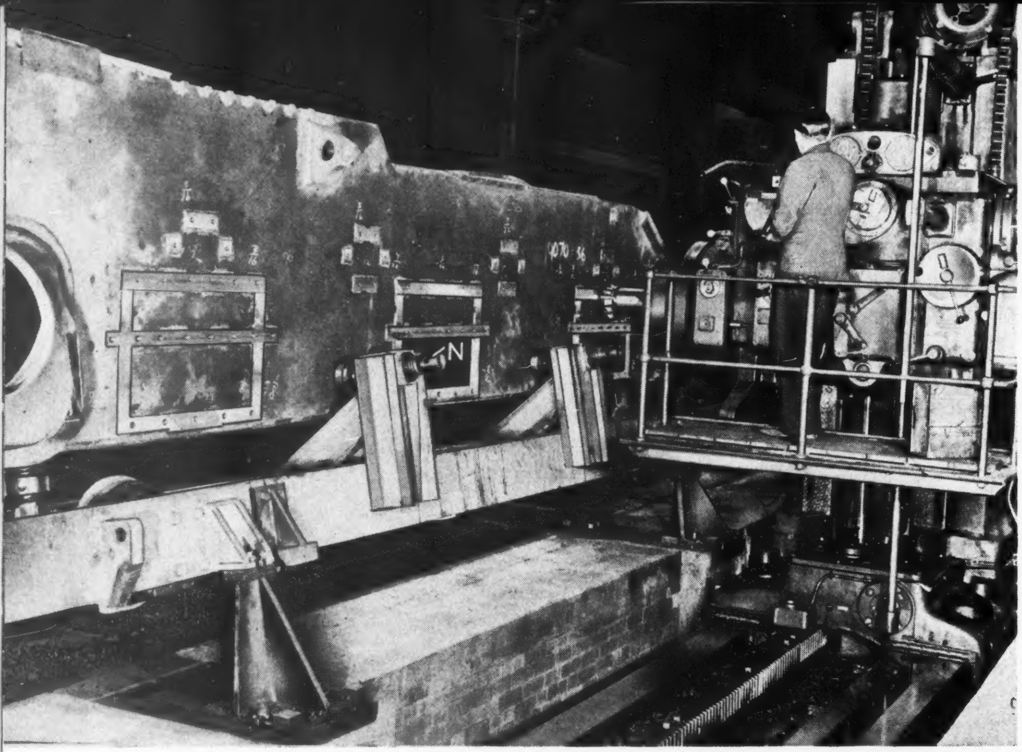


Fig. 11. The bogie jig on which the tank hull is mounted is tilted to an angle of 12 degrees for milling the suspension bracket facing strips

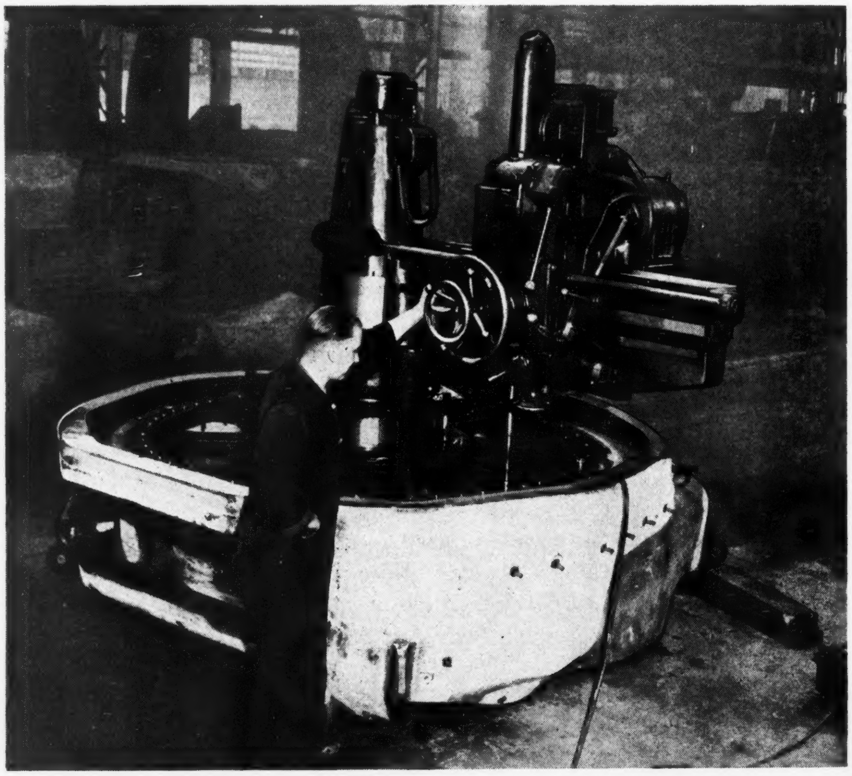


Fig. 12. Portable radial drilling machine consisting of an arm, column, and circular base, which is mounted on the tank turret for drilling the bearing-ring attachment holes

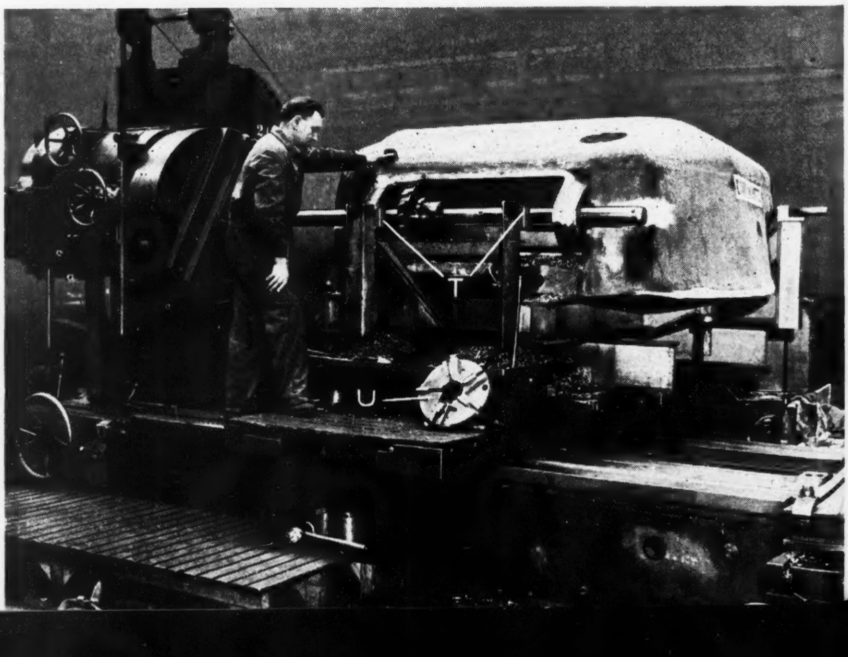


Fig. 13. Upper and lower surfaces of the mantel aperture in the tank turret are machined on a horizontal boring machine

the work is clamped to a fixed table between two horizontal boring and milling machines.

The finished size of the hole in each lug is 4.125 inches, and the tolerance is 0.001 inch. The required accuracy is insured after the hole has been drilled and bored by the use of an adjustable floating reamer with high-speed steel blades which remove about 0.006 inch of material. The turret casting is located on the table, and is positioned radially by means of an index-finger with which a marked line on the casting is set to coincide. Brackets fitted with hardened steel removable bushings are provided on the table to support the boring-bars.

This operation is followed by boring the upper and lower surfaces of the mantel aperture to a diameter of 15.5 inches, and machining the inside faces of the trunnion lugs. For these operations, the casting is clamped on a girder extension frame on the table of a horizontal boring machine, as shown in Fig. 13. Setting blocks are provided at *T*, from the front faces of which the lug bores in the casting are lined up. Hardened steel bushings are inserted in the lugs to provide support for the cutter-bar.

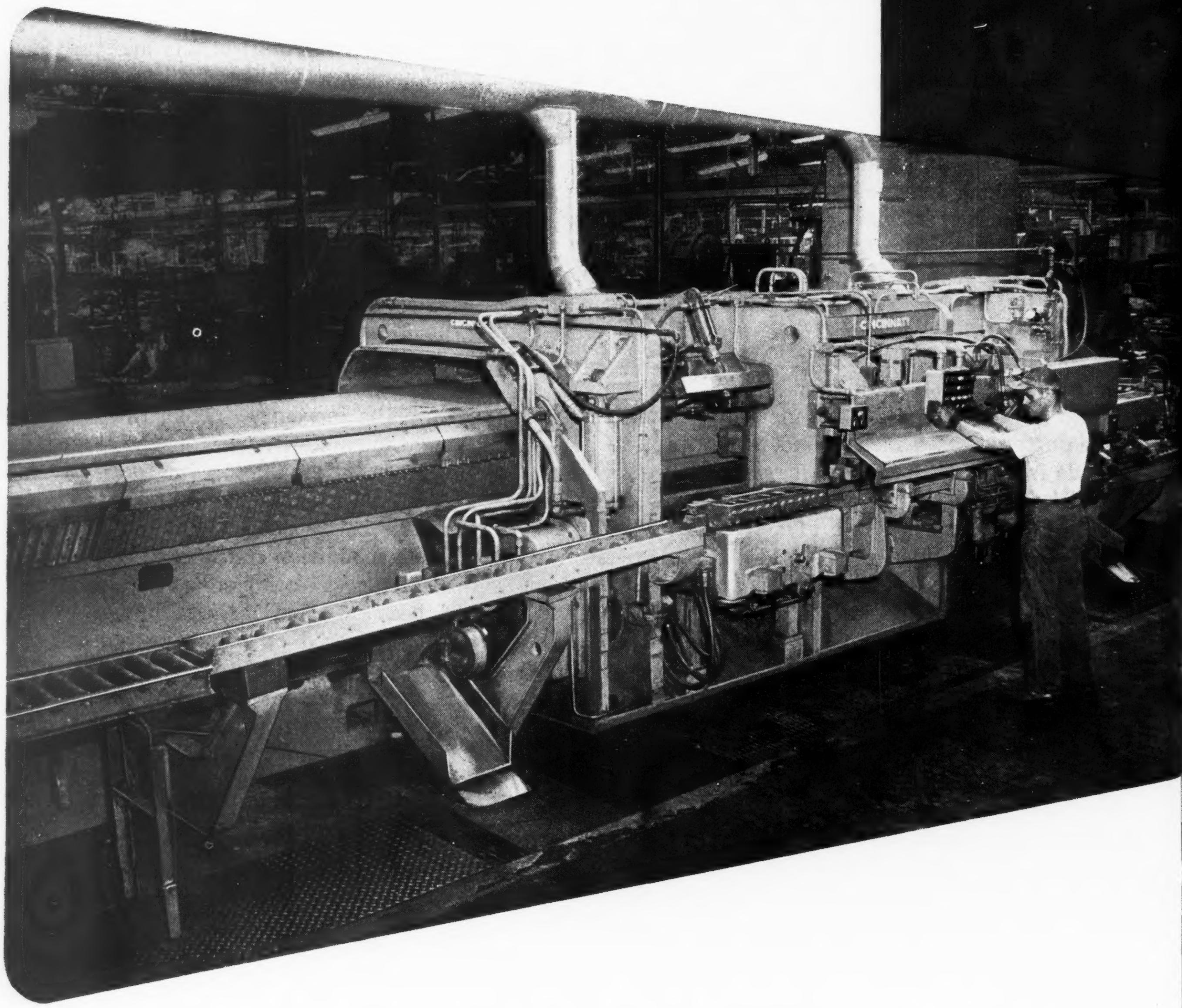
The boring operation is actually performed with an inserted-tooth milling cutter of exactly the diameter required. However, before this can be introduced, it is necessary, since the aperture is blind, to cut away a portion in the center, using a single cutter mounted in the cutter-head seen at *U*. The holder for this cutter is adjustable radially in the body, and the cut is applied, as the cutter-head slowly rotates, by turning a square-headed screw at the back.

When a sufficient length of the aperture has been machined by traversing the bar, the cutter is retracted and the cutter-head used for machining the inside face of the adjacent trunnion lug. This is accomplished by means of four cutters in the face of the cutter-head, which are staggered radially to distribute the cut. Upon completion of one face, the cutter-head is reversed on the bar.

A twenty-tooth inserted-blade milling cutter, seen in position in the machine, is now substituted for the cutter-head, and the aperture from the center to one end is machined, the cut being blended into the faced lug. Then the cutter is reversed on the bar for machining the other half of the aperture. High-speed steel tools are employed throughout, and the cutter rotates at a speed varying between 11 and 15 R.P.M., according to the condition of the casting.

A finished turret—complete with 20-pounder gun (the heaviest used in British armor)—is shown being lowered on the huge hull of the Centurion tank in Fig. 14. The turret rotates on a ball race approximately 7 feet 6 inches in diameter, which incorporates 1 1/4-inch diameter balls fitted with hardened steel spacer rings. Although the turret, including gun, driving mechanism, and other equipment, weighs nearly 13 tons, it must be possible to start rotation by the application of a comparatively light hand pressure at the muzzle end of the gun.

Fig. 14. Lowering a finished turret, complete with 20-pounder gun, on the hull of the Centurion tank



BOTH sides and the top and bottom surfaces of cylinder heads for the Buick "Fireball" eight-cylinder engine are being broached to a flat, smooth finish at a production rate of ninety-five heads per hour with only three operators. With previous practice, when the same surfaces were milled, only 8 1/2 heads were turned out per hour for each operator. In addition to the increase in production per operator of more than 300 per cent, the use of inserted type carbide cutters on the broaching machine has resulted in less maintenance, easier replacement and adjustment, a smaller inventory of replacement tools, and greatly increased cutter life between sharpenings.

The huge, two-way, horizontal broaching machine employed for this operation is seen in the heading illustration. This machine, manufactured by The Cincinnati Milling Machine Co., Cincinnati, Ohio, is capable of a peak output of 300 H.P. The drive, operated by a variable-voltage motor, is of the rack and pinion planer type. With this type of drive, the speed can be varied to broach at higher rates than is possible with hydraulically driven machines, and a speed most suitable for the existing production requirements can be selected. In comparison with some of the earlier hydraulic broaching machines, which operated at speeds of about 40 feet per minute, this new machine has a maximum ram speed of 140 feet per minute.

All four surfaces of the free machining, gray cast-iron cylinder head are rough- and finish-broached in one complete cycle, with two settings of the work. Two surfaces, the top and one side of the head, are completed as the ram moves to the right, and the other two surfaces are broached as the ram returns to the left. A roll-over fixture rotates the casting through an angle of 180 degrees between the first and second settings, and a rapid transfer mechanism moves it from one station to the next.

Buick Uses Carbide to Broach at 120 feet per Minute

By STANLEY J. WHITE
Superintendent of Engine Plant
Buick Motor Division, General Motors Corporation
Flint, Michigan

A Huge Two-Way Horizontal Broaching Machine Equipped with Carbide Cutting Tools is Used to Rough- and Finish-Broach the Top, Bottom, and Two Sides of Cylinder Heads at the Rate of Ninety-Five per Hour. Two In-Line Automatic Transfer Machines Drill, Ream, and Tap All Holes in the Heads

Cast cylinder heads come to the broaching machine from the foundry loaded on skids. An operator at the right end of the machine lifts the castings from the skids and places them on a roller gravity conveyor leading to the first or loading station, Fig. 1.

As a casting slides into the hydraulically operated, hinged type work-holding fixture, it is automatically located at three points—by two of the eight combustion chambers and a cast locating pad. Correct location is insured by air orifice controls. Blasts of compressed air, directed at specific points beside the head, must enter the orifices for the machine to operate. Illumination of a signal light informs the operator that correct three-point location has been established.

Hydraulic clamping of the cylinder head is effected by means of a single hand-lever, seen at the front of the fixture. Considerable improvement in the uniformity of product quality has been obtained with hydraulic clamping. Previously, in milling the cylinder heads, deflection of the casting was caused by variations in the pressure exerted when clamping manually.

After clamping the work, the operator depresses a cycle-start button which rotates the fixture through an angle of 90 degrees and moves the broaching ram to the right. At this stroke, the top (rocker-arm cover surface) and spark-plug side of the cylinder head are both rough- and finish-broached.

When the broach reaches the end of its stroke in this direction (approximately 12 feet), the cylinder head is swung back to its loading position and is automatically transferred into the roll-over fixture seen at the left in Fig. 1. Here the work is rotated through an angle of 180 degrees and transferred to the second station, Fig. 2. In the fixture at this station, the cylinder head is located from its two previously broached surfaces. The operator again clamps the cylinder head hydraulically and depresses another button, which rotates the fixture through an angle of 90 degrees and moves the broaching ram to the left. At this stroke, the bottom (combustion-chamber surface) and manifold-rail side of the cylinder head are both rough- and finish-broached.

At the end of the return stroke of the broach ram, the completely broached cylinder head is automatically swung back to its loading position and unloaded on the roller gravity conveyor leading away from the machine, as seen at the left.

With the ram speed of 120 feet per minute now being used, the potential capacity of the machine is 130 cylinder heads, or 520 surfaces, per hour. However, allowing for tool changes, adjustments, etc., the net production now obtained is 95 per hour. Chips fall on a chip conveyor running in a trench below the floor in front of the machine. The castings supplied to the machine must be dry to prevent chipping the

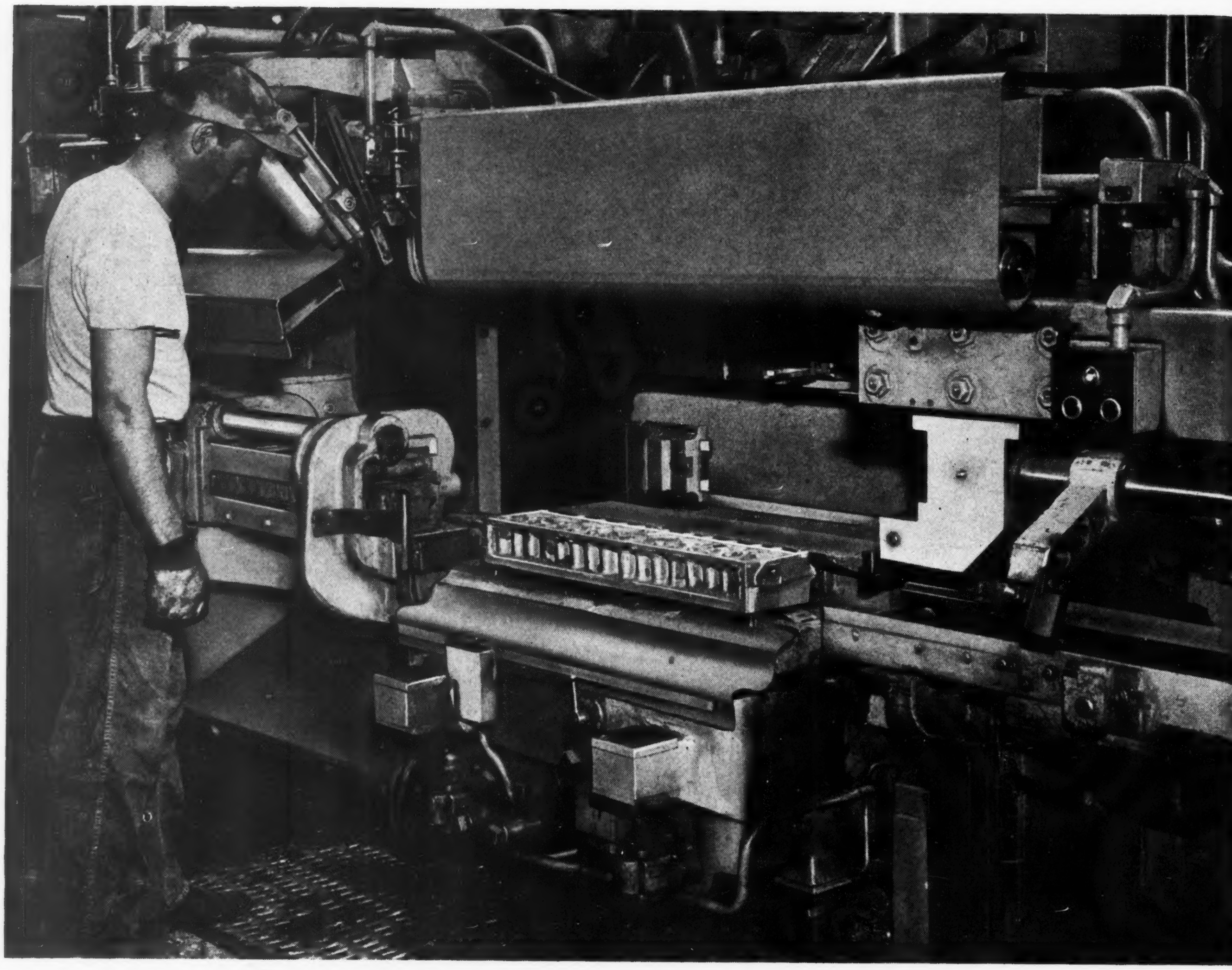
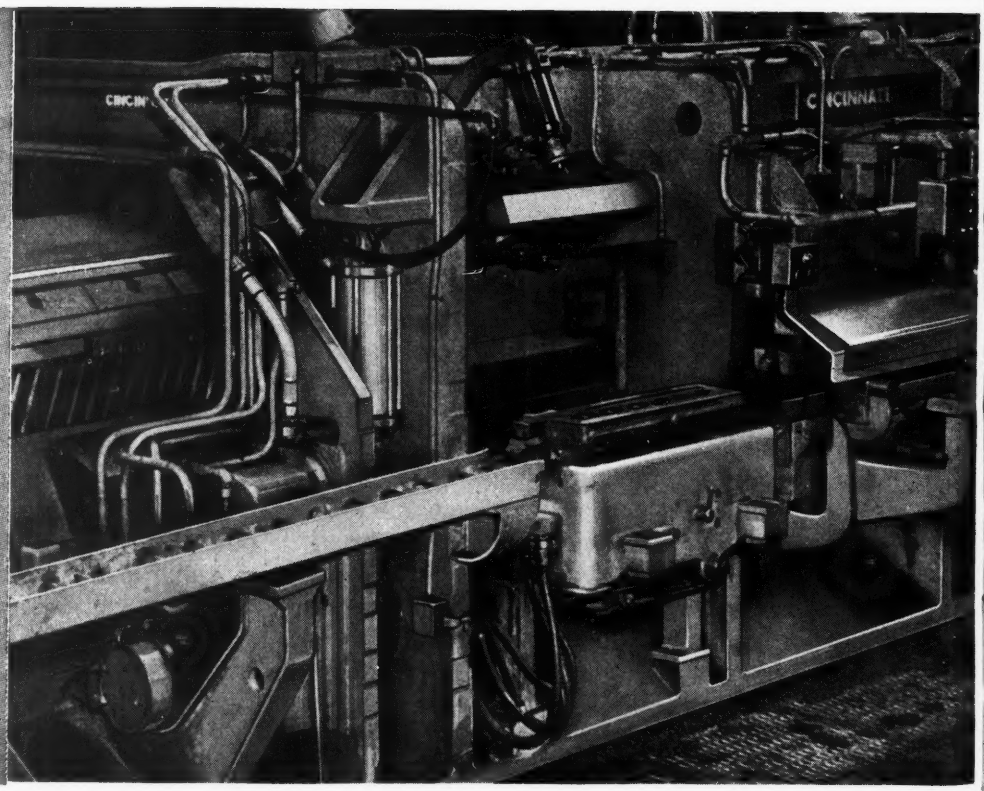


Fig. 1. (Above) First or loading station of two-way, horizontal broaching machine seen in the heading illustration. The work is clamped hydraulically and then rotated through an angle of 90 degrees in the vertical plane for broaching the top and spark-plug side of the head

Fig. 2. At second station, the cylinder head is again clamped in a hydraulically operated, hinged type work-holding fixture for broaching the bottom and manifold side of head



carbide, and no coolant is employed during the broaching operations.

The lower or combustion-chamber surface of the cylinder head is broached flat and parallel within 0.003 inch. Over-all thickness of the head is held to $\pm$ 0.004 inch, and depth of the combustion chambers to $\pm$ 0.002 inch. Snap gages and dial indicators are employed to inspect the broached heads at periodic intervals.

The use of carbide tools and the design of the inserts are recent innovations that have greatly improved the technique employed in broaching cast iron. There are four broaches mounted in opposed pairs on the ram of the machine, each pair containing a wide broach for roughing and finishing either the upper or lower face of the cylinder head and a narrower broach for roughing and finishing one rail side.

Each broach is made up of three sections containing roughing tools and one section containing finishing blades. The broach sections are all about 40 inches long. The three roughing sections for broaching the top and bottom surfaces of the heads are composed of carbide-tipped bits. Since the castings come from the foundry with hard fins on their cover and manifold faces, the first few teeth of the first roughing section for these faces are solid Tantung (cast alloy) blades. These teeth remove the fins before the surfaces are rough-broached with the carbide-tipped bits. The finishing section on each broach contains fifteen solid carbide blade type teeth.

The total number of teeth used on all four broaches is 737. The distribution of teeth for the various surfaces broached is as follows: Top face, 162 carbide-tipped bits and 15 solid carbide blades; cover face, 11 solid Tantung blades, 198 carbide-tipped bits, and 15 solid carbide blades; bottom face, 162 carbide-tipped bits and 15 solid carbide blades; and manifold face, 12 solid Tantung blades, 132 carbide-tipped bits, and 15 solid carbide blades.

A partial drawing of one of the first rough broaching sections is seen in Fig. 3. Section *X–X* shows how the blade type teeth are held by steel wedges and socket-head cap-screws, while section *Y–Y* illustrates the method of clamping the carbide-tipped teeth. Tips for the square-shank, single-point roughing tools are made from Carboloy Grade 44A carbide, while the blade type finishing tools are made from solid blanks of Grade 883 carbide. The broach-holders are forged from SAE 3150 steel, and hardened to 50 Rockwell C.

As can be seen from the drawing, the broach-holders need not be removed in order to sharpen the tools, since any individual tool that is worn can be removed and replaced with a sharp tool in a few minutes. Each of the single-point, carbide-tipped roughing tools can be adjusted for height independently by means of a lock-nut and screw provided in the end of the tool shank. The heads of the adjusting screws rest on back-up plates. Each row of roughing tools is provided with a back-up plate which fits into a slot machined across the under side of the broach-holder and is bolted to the holder. The increased depth of cut per row of roughing tools is obtained by progressively increasing the thickness of the back-up plates.

In this way, all of the roughing tools can be made identical in over-all length, and only a small number of replacement tools need be carried in stock. Also, only one fixed-height gage is necessary to adjust the height of the tools after sharpening. The blade type solid carbide or cast alloy tools are generally removed and sharpened as a unit, but they, too, can be replaced individually.

Total stock removal per surface averages about 3/16 inch, although fins on the parting

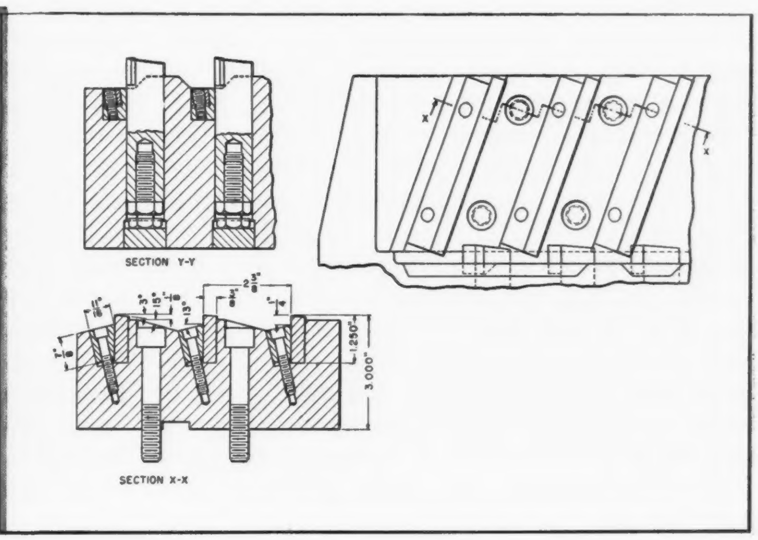


Fig. 3. Part of the first roughing section of the broach employed in machining cylinder heads. Blade type cast-alloy cutting teeth are held as seen in section (X-X), while single-point, carbide-tipped tools are clamped as illustrated in section (Y-Y)

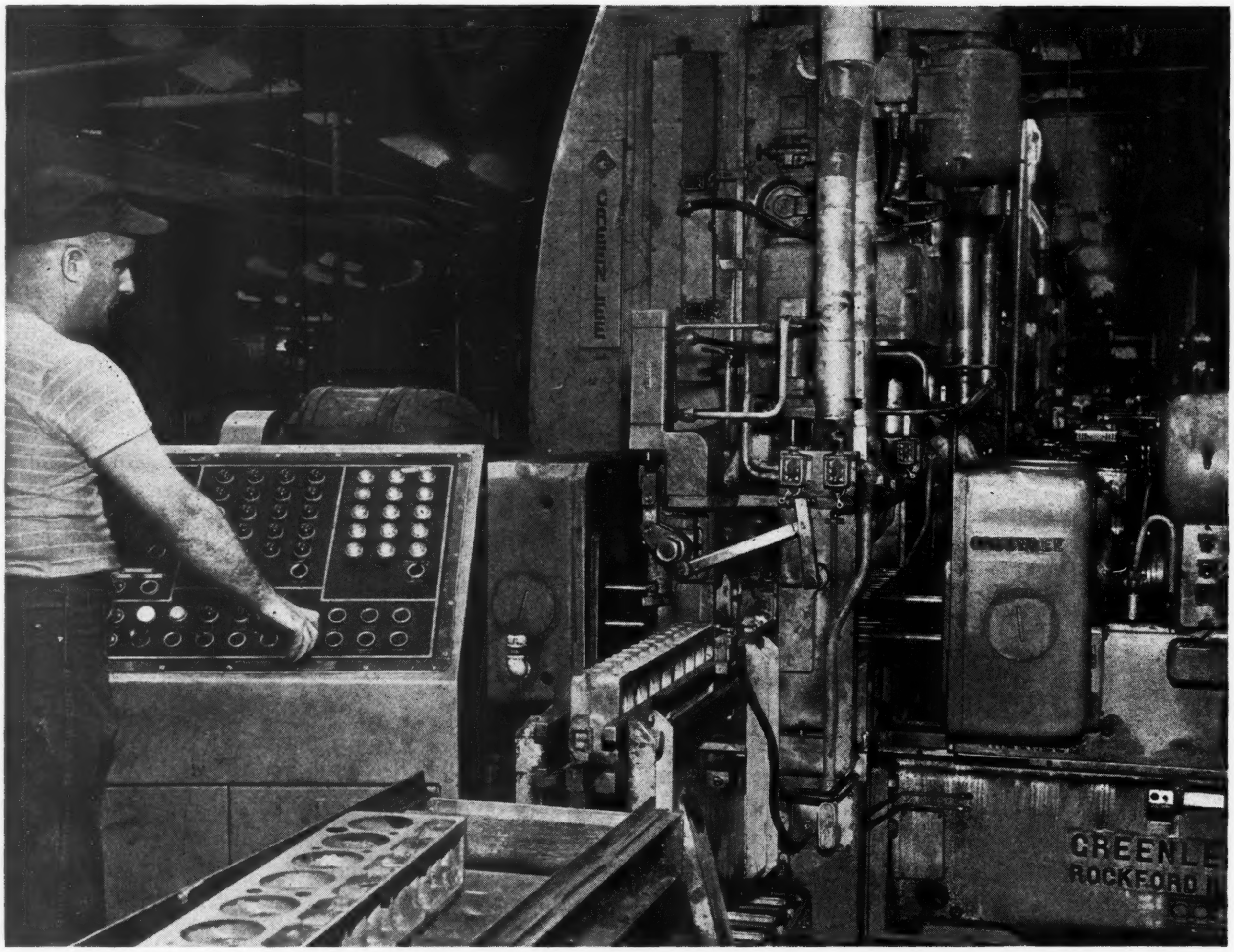


Fig. 4. Loading end of a fifteen-station automatic transfer type machine employed to drill, ream, chamfer, or mill various holes in the cylinder heads at the rate of seventy-four per hour

lines of the castings sometimes increase this to as much as 3/8 inch. Of the total stock removal, from 0.020 to 0.025 inch is taken off by the fifteen finishing tools. The relatively large stock removal effected during finishing has been found to reduce the break-out or crumbling of metal at the outer edges and around the periphery of openings in the casting that is gradually caused during rough-broaching. In this way, break-out is held to a maximum of 1/32 inch.

The broaching machine has not been operating sufficiently long to know when the tools will require sharpening. The only tools replaced thus far have been a few broken ones. It has been estimated that a minimum life between sharpenings of the tools will be 25,000 cylinder heads. This is more than eighteen times the life previously obtained when milling the heads. It is anticipated that the life of the tools used to broach the top surface of the cylinder head will be much longer than that of the tools broaching the lower or combustion-chamber surface of the head because the latter requires more interrupted cutting and must be held to closer flatness tolerances.

From the broaching machine, the cylinder heads pass through two in-line, transfer type machines in which all holes in the heads are drilled, reamed, chamfered, counterbored, milled, or tapped. By combining operations, using faster feeds and speeds, and increasing the transfer rate, these two machines now perform the same operations at a higher production rate than that previously obtained from four separate machines. The net production now obtained from each of the two transfer machines is seventy-four cylinder heads per hour. Drilling speeds employed on both machines average about 70 surface feet per minute, and feed rates vary up to a maximum of 3 1/2 inches per minute.

On the Greenlee fifteen-station automatic transfer machine seen in Fig. 4, bolt, manifold face, exhaust and intake guide, push-rod, bracket, oil-line, cover-stud, water, and gasket-dowel holes in the cylinder heads are drilled, reamed, chamfered, or milled. Loading and unloading

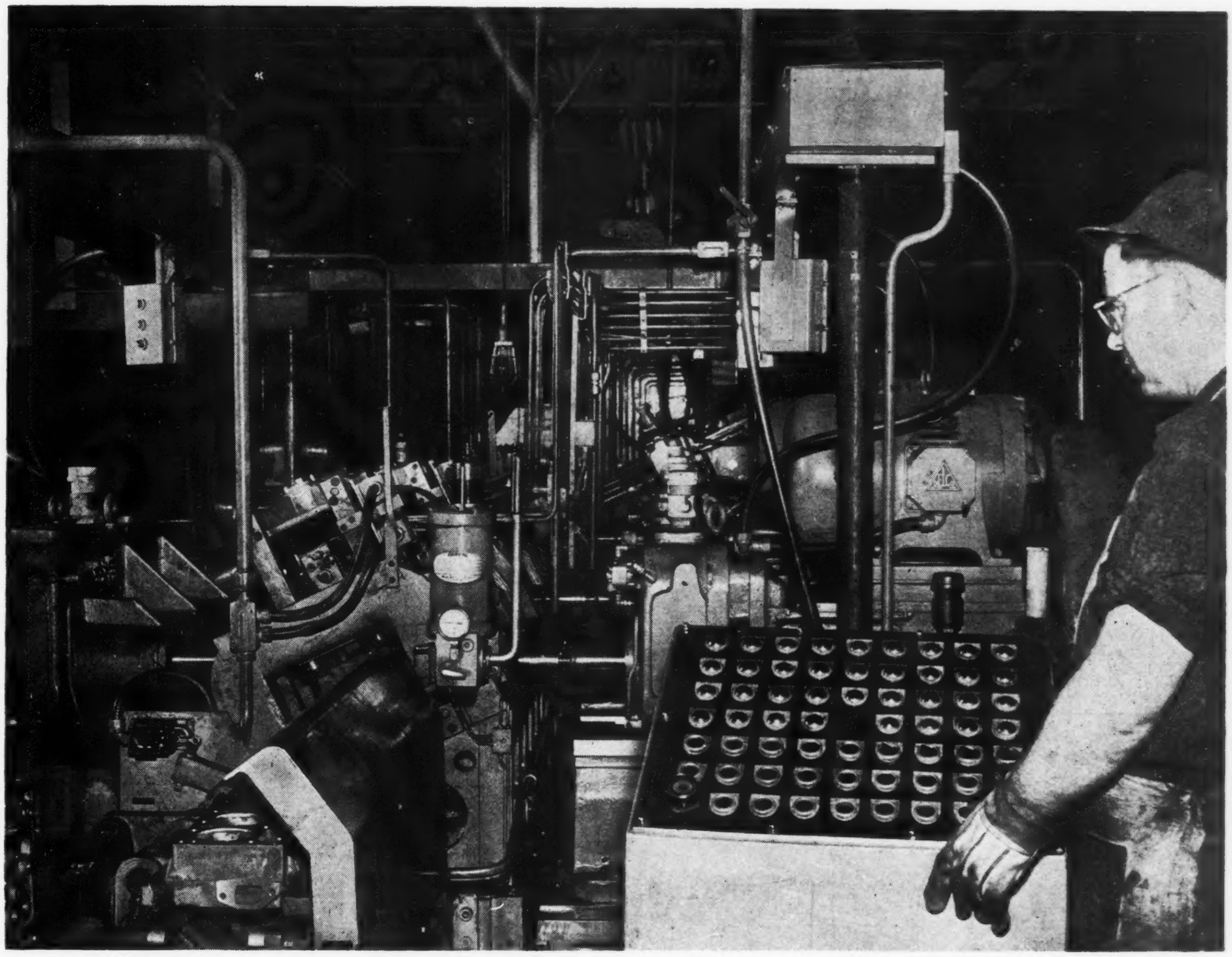


Fig. 5. Eight spark-plug holes in each cylinder head are drilled, reamed, counterbored, tapped, spot-faced, and chamfered on a ten-station transfer machine containing 103 spindles

are performed at Stations 1 and 15. At the remaining stations, one left-hand vertical head, seven left-hand horizontal heads, and ten right-hand horizontal heads are equipped with a total of 239 operating spindles. Several non-operating spindles are provided on a few of the heads, and Stations 4 and 11 have been left idle to take care of changes in product design.

Holes in the cylinder head vary from 0.261 to 0.6562 inch in diameter. Several of the horizontal heads, both left- and right-hand, are equipped with twenty-two spindles each, for drilling bolt-holes 0.4844 inch in diameter. An eight-blade, tungsten-carbide tipped milling cutter, 5 inches in diameter, on the right-hand horizontal head at the fifth station faces the water outlet boss.

At the completion of the operations just described, the cylinder heads are loaded into a W. F. and John Barnes ten-station, automatic transfer machine, Fig. 5. On this machine, the eight spark-plug holes in the head are drilled, reamed, counterbored, and tapped, and other holes are drilled, chamfered, and tapped. The left side of the machine is provided with three horizontal heads and three angular heads, while the right-hand side has four horizontal, one angular, and one vertical head. The twelve heads have a total of 103 operating spindles.

Cylinder heads are loaded at the first station, automatically rotated through an angle of 360 degrees by means of a turn-over fixture at the seventh station, and unloaded at the tenth station. The fourth station and several spindles on the heads at other stations are idle.

The spark-plug holes are drilled to a diameter of 0.4687 inch, reamed to 0.498 inch, and threaded with a 14-millimeter tap (having a pitch diameter of 0.5212 to 0.5217 inch) at the second, sixth, and eighth stations by means of heads on the left-hand side of the machine. Wrench clearance holes for the spark-plug holes are counterbored, and the holes are spot-faced and chamfered by right-hand heads at the second and third stations. The largest hole (5/8 inch in diameter) tapped in the cylinder head is the thermometer-well hole, which has eighteen threads per inch.

DESIGNING HOPPER FEEDS for Square and Hexagonal Nuts

By J. R. PAQUIN
Tool Engineering Consultant
Hartford, Conn.

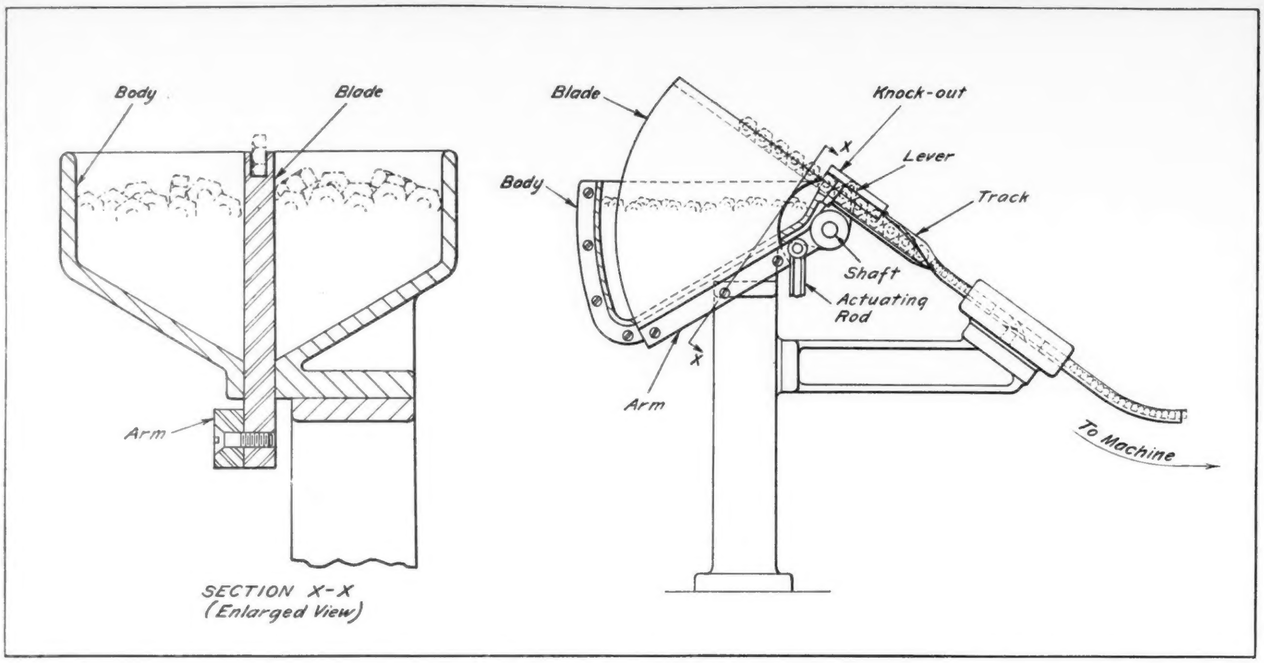


Fig. 1. Centerboard type of hopper and separator mechanism for feeding properly positioned nuts to an automatic machine

NUTS—both square and hexagonal—are employed in such large quantities as fastenings that the problem of automatically feeding parts of this type to various machines often confronts tool engineers and machine designers. Occasionally, the nut blank must be transferred to machines that perform secondary operations. In other cases, the finished nut must be automatically delivered to a particular location for assembly to other components.

A number of hopper designs have proved successful for handling work of this kind. Among these are the centerboard, the paddle wheel, and the rotary hopper types. Choice of the correct form of hopper to use will depend upon production requirements and, to a certain extent, upon the size of the nuts.

The centerboard type of hopper is widely employed for small and medium size nuts, either square or hexagonal in shape. Because of its low cost, large capacity, and excellent operating efficiency, this type of hopper should receive first consideration when a part delivery problem is met. A centerboard type of hopper and separator mechanism for feeding square or hexagonal nuts, properly positioned, to an automatic machine is illustrated in Fig. 1.

The hopper consists of a body, usually made in two parts as shown in section *X–X;* and a blade, fastened to an arm, which oscillates through the mass of parts that have been previously placed in the hopper. Parts that happen to be in the correct position drop into a groove machined in the top edge of the blade, and are

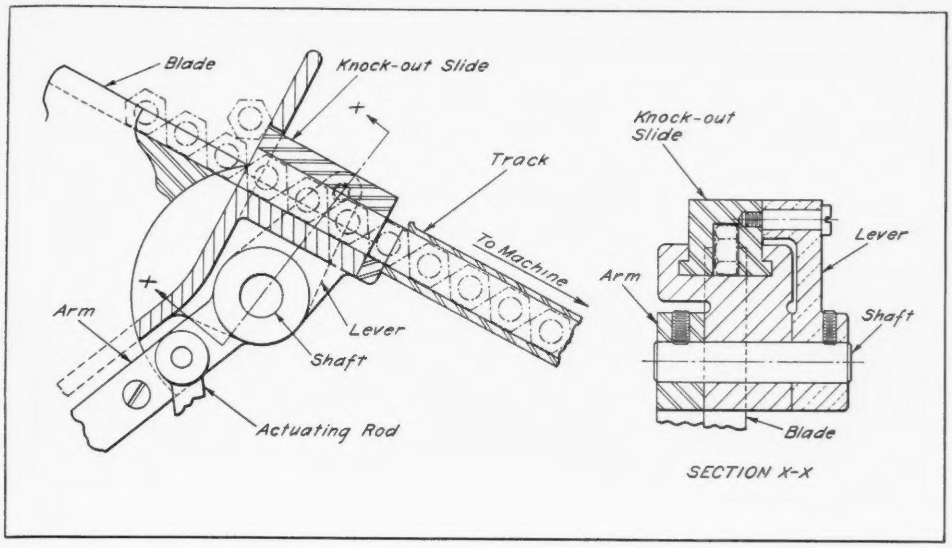


Fig. 2. Enlarged sectional view through the knock-out mechanism of hopper seen in Fig. 1. Oscillation of the knock-out slide clears the track mouth of improperly positioned parts

raised by the blade in its upward travel. At its uppermost position, this groove is in line with a track, down which the nuts slide toward the machine. An actuating rod transmits motion to the centerboard blade from a cam or crank, not shown in the drawing. The centerboard arm is fastened to and pivots about a shaft.

A lever projecting from the opposite side of this shaft operates a knock-out slide. The knock-out slide advances, upon descent of the centerboard blade, and clears the mouth of the track of any parts obstructing it. An enlarged sectional view through the knock-out mechanism is seen in Fig. 2.

In cases where it is planned to use the hopper for more than one size of nut, the centerboard blade should be constructed sectionally, as shown in Fig. 3. The two positions in which it is possible for the nuts to be raised by the blade are shown at *A* and *B*. A replaceable cap, keyed to the centerboard blade, is fastened by means of

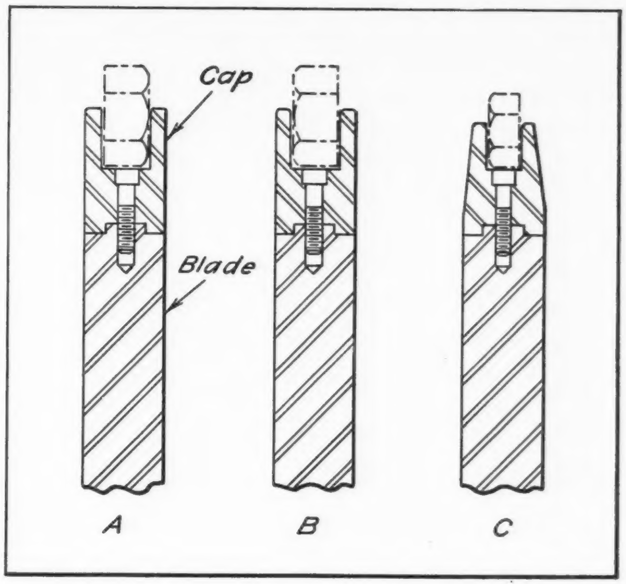


Fig. 3. Sectional construction of the centerboard hopper blade permits rapid change-overs for different sizes of nuts

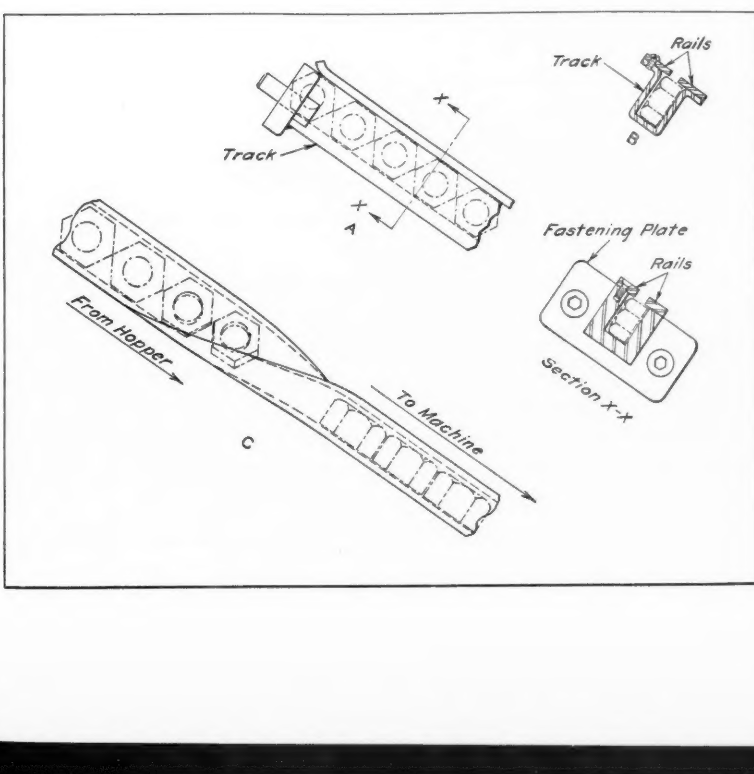


Fig. 4. Details of track construction shown in their position relative to the hopper. The track shown at (A) is machined from bar stock while that at (B) is formed from sheet metal

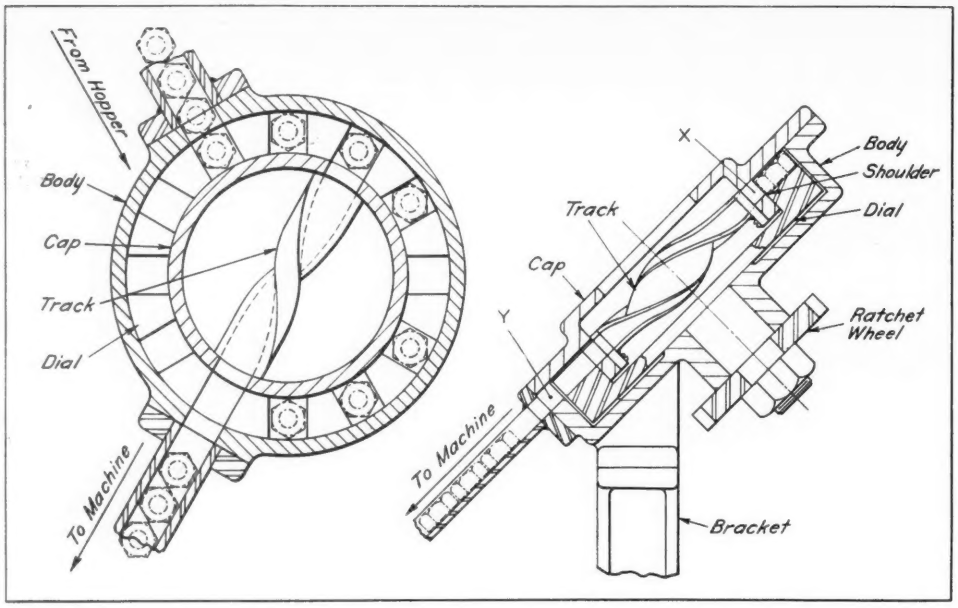


Fig. 5. Selector mechanism for inverting improperly positioned hexagonal nuts prior to delivering them to an automatic machine

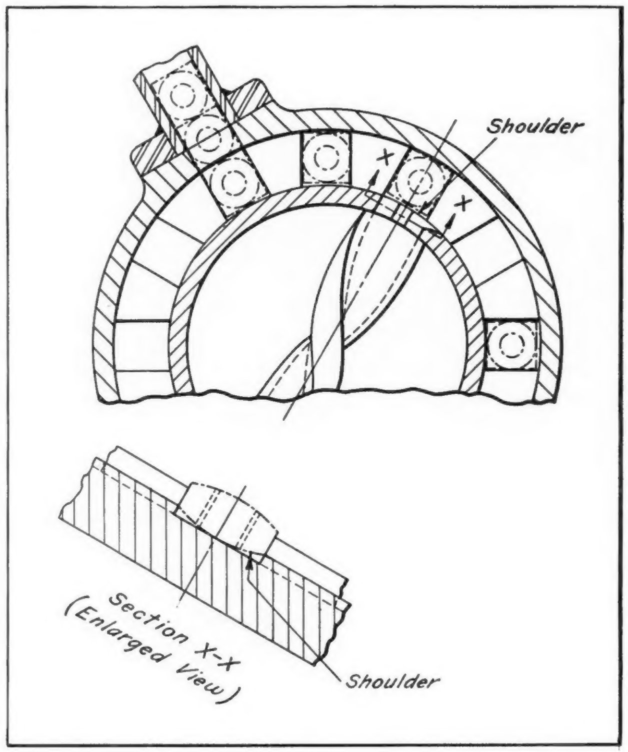


Fig. 6. Selector mechanism for correctly positioning square nuts before delivering them to the machine

socket-screws as shown. In this manner, the feed mechanism can be quickly changed for a part of another size, as shown at *C*.

One method of constructing the track that delivers the parts to a selector mechanism or to the machine is illustrated at *A* in Fig. 4. The track is a steel bar in which a slot has been milled longitudinally to accommodate the parts. Two rails are fastened to the track by screws, as shown in section *X–X*. This construction allows the operator of the machine to push the parts along with a screwdriver should they jam due to one of the parts being slightly over size.

The end of the track is welded to a fastening plate, which is secured to the hopper with screws. At the opposite end of the track, a similar plate is fastened to the selector mechanism in the same manner. This allows quick removal of the track when changing the set-up for other sized nuts.

A less expensive type of track construction is illustrated at *B*. In this case, the track is made of heavy-gage sheet metal, formed as shown. Rails, fastened to the track with small screws, permit dislodgment of jammed parts through the central gap between them.

A quarter twist may be applied to the track at a position between the hopper and the selector mechanism, or between the hopper and the machine, when the parts must be delivered in a horizontal position. Such a twist in the track is illustrated at *C*. Generally, a considerable amount of hand filing or grinding must be done on the walls of the track at this point to enlarge the sides for proper clearance of the parts.

Selector Mechanism for Hexagonal Nuts

The construction of one type of selector mechanism employed to turn improperly positioned hexagonal nuts upside down is illustrated in Fig. 5. The sectional view at the right shows the relative position in which the mechanism is mounted on the machine.

The selector mechanism consists of a cast body, which is fastened in a stationary position to a

bracket on the machine; a cap, screwed and doweled to the body, which holds the twisted track of the mechanism; and a dial, free to rotate intermittently within the body and driven by a ratchet wheel.

In operation, the nuts enter the dial from the hopper track, as seen at the left. As the dial indexes, the nuts are carried to a position opposite the mouth of the twisted track. At this point, an opening X has been machined in the stationary cap in such a manner that a shoulder is formed between the cap and the body.

If the nuts are properly positioned (that is, if the flat side of the nut is down), this shoulder prevents them from entering the track, and they are carried around by subsequent indexes of the dial to point Y. Here they pass through an opening in the body, enter another track, and slide down to the machine.

However, when nuts enter the selector mechanism incorrectly positioned (with their curved side down) and reach the point opposite the track mouth, they slide over the projecting shoulder and enter the twisted track. In sliding through this track, they are turned over and enter the track leading to the machine correctly positioned for assembly.

Owing to the extremely slight projection of the shoulder, all parts of the selector mechanism must be made sufficiently strong and fitted precisely to eliminate vibration. Improper fitting or vibration might allow properly positioned parts to jump over the shoulder and slide toward the machine resulting, of course, in incorrect assembly. The ratchet that indexes the dial should be driven by a crank. If a cam is employed, it should be of the harmonic motion type to give gradual acceleration and deceleration.

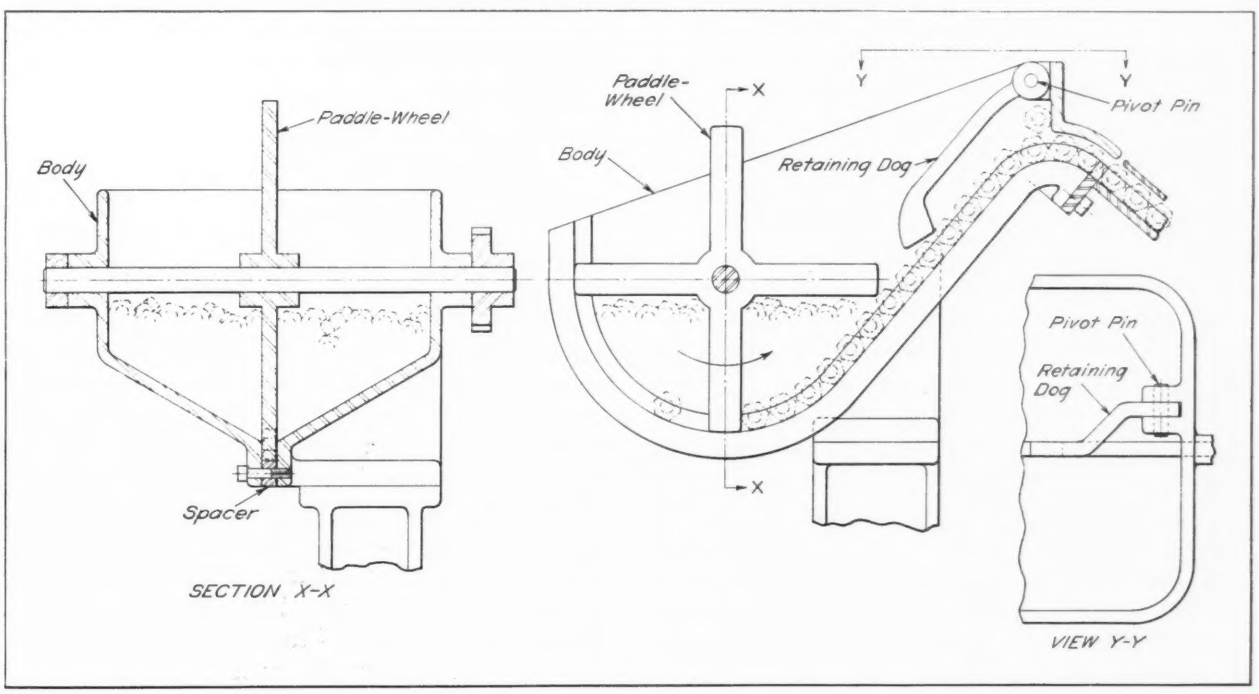
The same basic type of selector mechanism can be used for square nuts, as seen in Fig. 6. However, in this case, the selector shoulder is formed differently, due to the altered contour of the part. It will be noted that the shoulder projects upward at the corners, thereby preventing properly positioned nuts from entering the twisted track. Incorrectly delivered nuts, however, slide over this shoulder and are inverted by the twisted track prior to entering the machine.

Design of Paddle-Wheel Hoppers

Another type of hopper frequently employed to feed nut blanks to automatic machines is the paddle wheel type shown in Fig. 7. This consists of a body which is made in two halves that are fastened together with screws and dowels. A spacer, slightly wider than the nuts, is provided between the body halves to allow the nuts to slide freely between the confining portions of the body. When parts are dumped indiscriminately into the hopper, a few will fall into the track formed in the bottom. The rotating paddle wheel pushes the nuts upward, and when they reach the top of the hopper, they enter a track and slide down to the machine.

A retaining dog, which pivots loosely on a pin,

Fig. 7. The paddle wheel type of hopper is an effective means of feeding square or hexagonal nuts to automatic machines



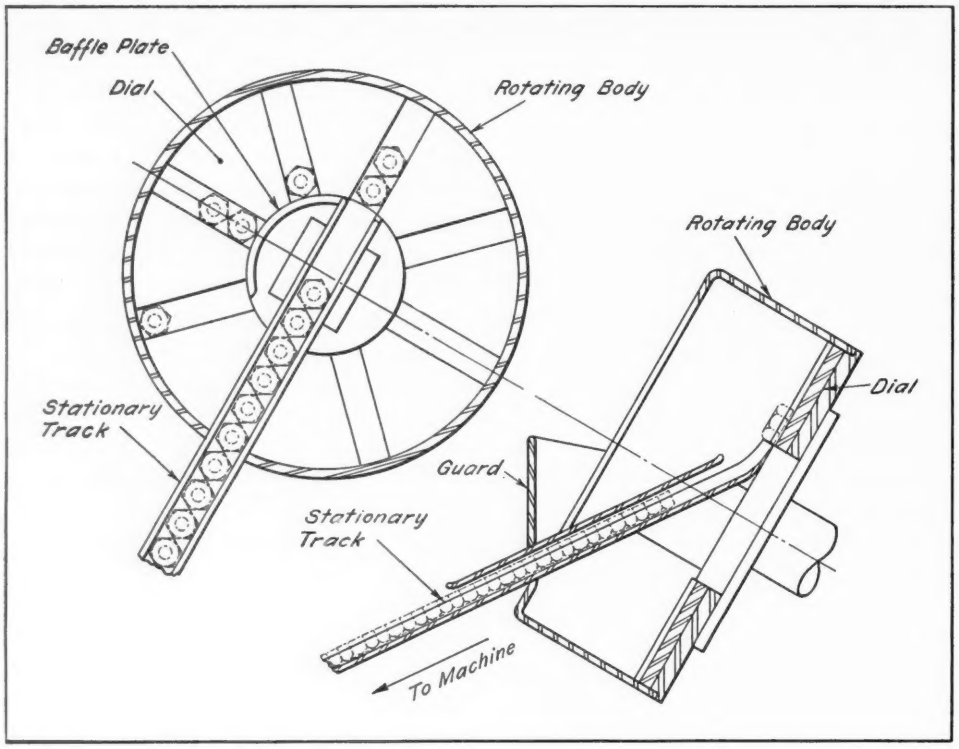


Fig. 8. Rotary type hoppers consist essentially of a rotating body and dial, a stationary track, a baffle plate, and a guard

prevents the nuts from sliding back every time one of the blades of the paddle wheel clears the track and before the next blade has advanced more blanks to push the row upward. While it is not absolutely necessary, such a retaining dog adds to the smooth operation of the hopper. An offset is provided at the pivoting end of the dog, as shown in view $Y-Y$, to allow the nuts to slide up the face of the hopper when the track is full. These parts then fall back into the hopper.

Construction of Rotary Hoppers

Rotary hoppers, such as the one seen in Fig. 8, can also be arranged to feed nuts to automatic machines. The hopper shown consists of a rotating body attached to a dial. The dial has radial slots milled in it, as shown. A stationary baffle plate prevents the nuts that are being carried upward in the slots from falling back into the hopper. As these parts reach a position opposite the mouth of the stationary track, they enter the track and slide toward the machine. When the track is full, the nuts go past the track mouth and drop back into the hopper.

As in the selector mechanisms described, a shoulder can be arranged at the track mouth to allow only correctly positioned parts to enter, if this feature is desired. In such cases, of course, the track must be given a half twist at some point between the selector and the machine, so that the nuts will be delivered in the correct position for assembly. The guard shown increases the capacity of the hopper.

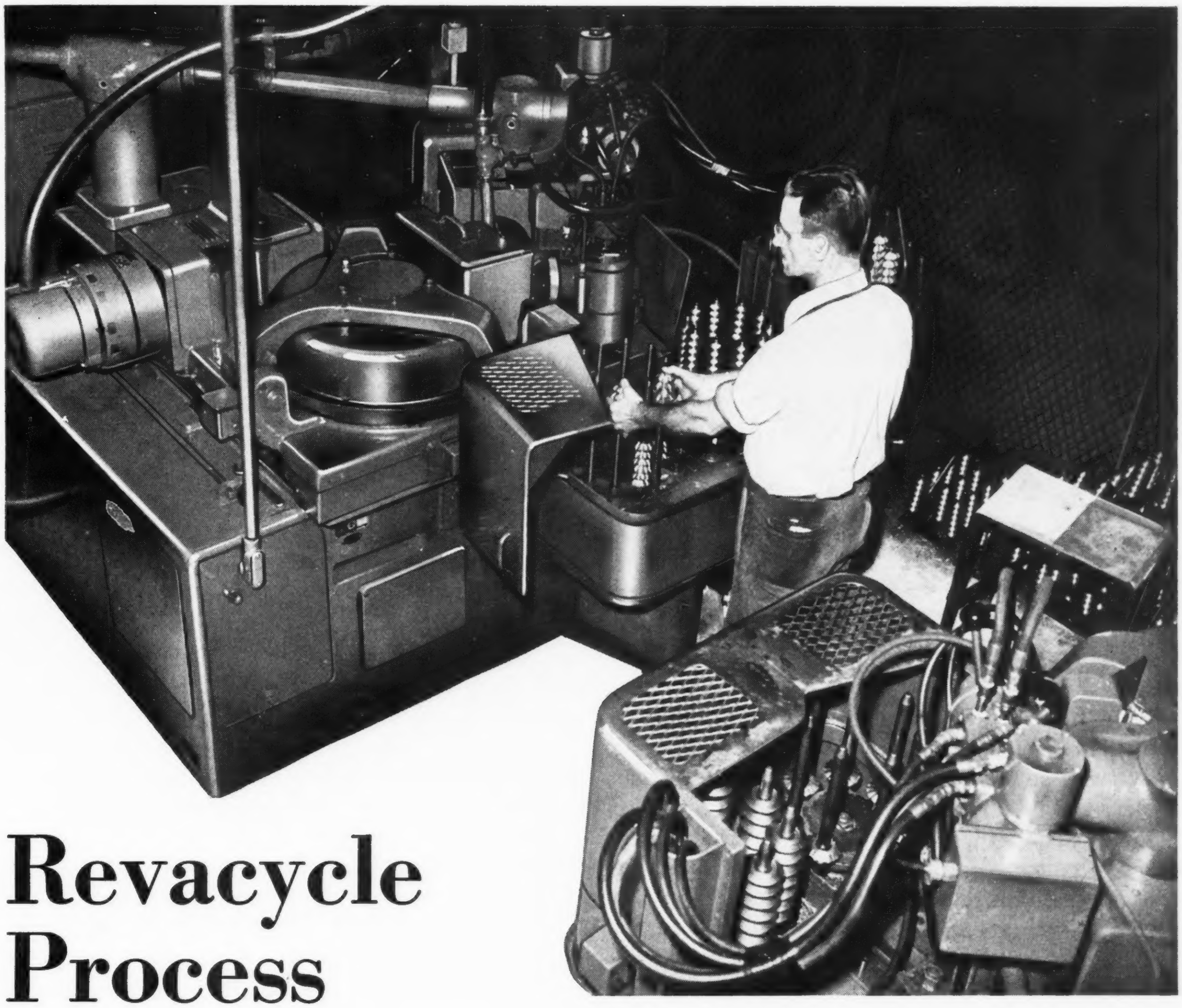
While both square and hexagonal nuts lend themselves well to hopper feeding, a considerable amount of thought must be given to each individual problem in order to determine the best possible hopper arrangement for each particular case. The component parts of the hopper and selector mechanism must be strong and rigid, and must be machined with smooth finishes and to close tolerances. Sudden jarring motions must be avoided, especially in the selector mechanism.

In other words, the hopper feed must be designed and built with the same care that is given to the machine to which it is applied. Flimsy, poorly designed mechanisms are the principal cause of the difficulties many plants have experienced with hopper feeds.

* * *

E. H. Horton & Son Co. Completes One Hundred Years

In the year 1851, Eli Horton established a factory in Windsor Locks, Conn., exclusively for the manufacture of lathe chucks. At the beginning, a universal chuck designed by Horton was produced, but the company soon engaged also in making a variety of two-, three-, and four-jaw chucks. The line today includes four-jaw independent chucks, faceplate and boring mill jaws, scroll universal chucks, three- and four-jaw scroll combination chucks, and two-jaw lathe chucks. Officers are Donald B. Huntting, president, and Douglas H. Thomson, Jr., vice-president.



Revacycle Process

Increases Chrysler's Gear Production

Straight Bevel-Gear Teeth are Rough- and Finish-Machined and Chamfered in One Automatic Operation. Blanks are Automatically Chucked and Completed Gears Unloaded on the Revacycle Machine. This High-Speed Process Has Resulted in Reducing Costs by One-Third or More

By CHARLES H. WICK

DIFFERENTIAL pinions and side gears for automobiles and trucks made by the Chrysler Corporation are being produced at much higher rates—and at considerable savings—by means of the Revacycle process. This process, which makes use of the Revacycle machine, is the fastest known method of generating straight teeth on bevel gears.

In a completely automatic cycle, a blank is loaded, the gear is machined, and the finished part unloaded. With each revolution of the large-diameter cutter, a tooth space is rough- and finish-formed from the solid metal, and adjoining faces of two consecutive teeth are chamfered. The blank is indexed after each revolution of the cutter until the gear is completed. Blanks incorrectly positioned on the loading spindles or having over- or under-size bores are automatically rejected without interfering with production.

Differential side gears, Fig. 1, produced on

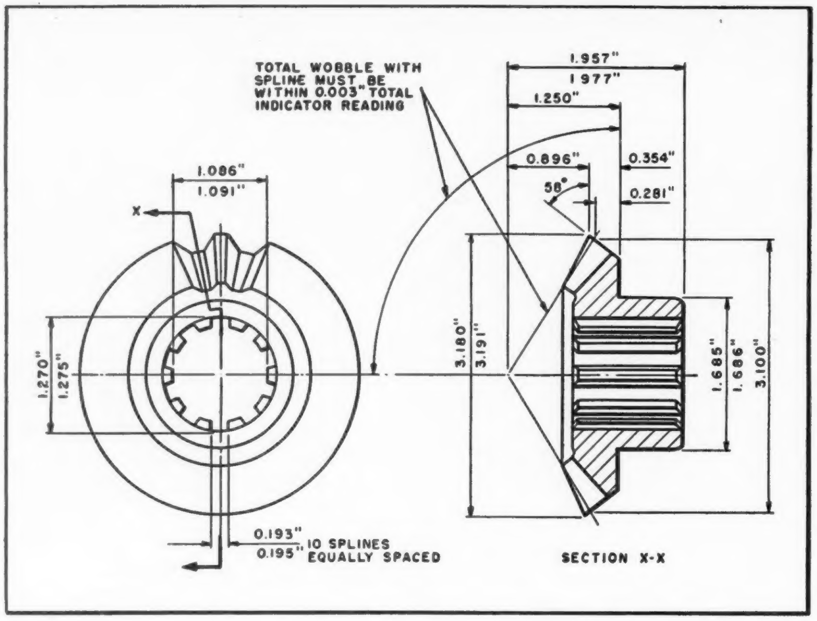


Fig. 1. Differential side gear for automobiles and trucks in which sixteen teeth are rough- and finish-formed and chamfered at the rate of sixty-two gears per hour on the Revacycle machine seen in the heading illustration

these machines have sixteen teeth, a pitch diameter of 3.100 inches, and a tooth working face of 0.600 inch. The teeth on such gears are rough- and finish-formed and chamfered at the rate of sixty-two gears per hour on each Revacycle machine. Only 2.65 seconds of machining time are required per tooth. Previously, the teeth of these gears were rough- and finish-formed in separate operations on different machines. The production obtained with the older method was only forty-two per hour in roughing, and twenty per hour in finishing.

Another example of the high cutting speeds obtained with these new machines is the production of differential pinions. Such gears, having ten teeth, a pitch diameter of 1.9375 inches, and a tooth working face of 0.600 inch, are completed at the rate of ninety-five per hour on one machine. Each tooth is rough- and finish-formed and chamfered in 2.65 seconds. By the method formerly used, the pinion teeth were rough-formed on one machine at the rate of sixty-nine per hour, and finish-formed in a separate operation at the rate of thirty-two per hour.

The Revacycle process is a special method of generating straight bevel-gear teeth. The stub teeth generated in this way have proportions different from the teeth of other straight bevel gears, and such gears are not interchangeable with, and cannot be operated in mesh with, gears

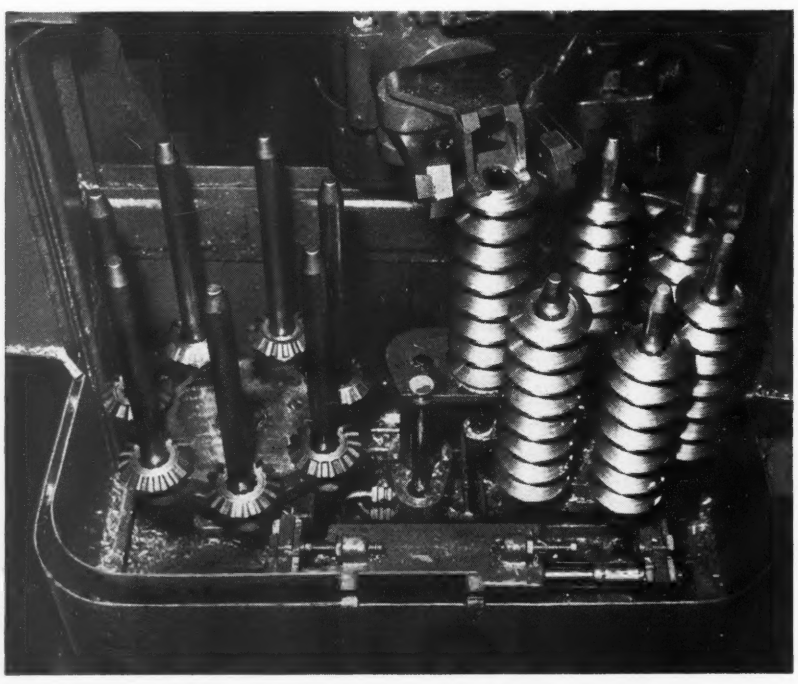


Fig. 2. A stack of gear blanks is hydraulically lifted and the top blank is gripped by a pair of jaws on a swinging arm, which carries the blank to the work head and slides it onto an arbor

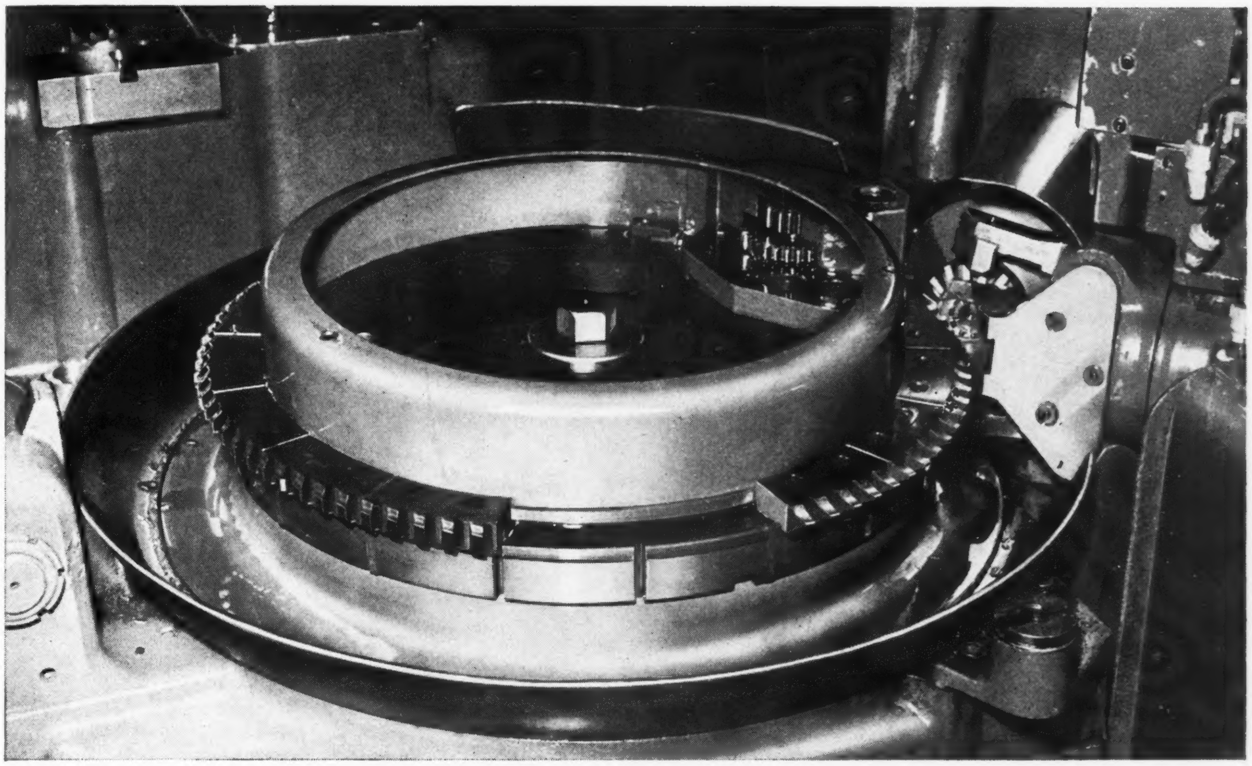


Fig. 3. Close-up view of the Revacycle machine with the cutter cover removed. Finishing blades are seen in contact with the gear being machined, while roughing blades are at left

generated by other methods. The pressure angle of the gears produced in this way is approximately 22 1/2 degrees. Face widths of Revacycle teeth are approximately one-third the cone distance, and the face and root angles do not pass through the pitch apex. An important advantage of this type of tooth is that a localized bearing area is produced in the center of the tooth face.

Blanks machined by this process must be specially designed, and considerable calculation is necessary to arrive at the proper blank dimensions and machine settings. For these reasons, the Revacycle process is used primarily for high-quantity production. However, only a few cutters are necessary for a wide variety of gears. Each pair of cutters will produce a series of seven combinations: 10/14, 10/15, 10/16, 10/17, 10/18, 10/19, and 10/20. Five standard pairs of cutters will therefore produce a total of thirty-five possible gears, with cone distances varying from 1.28 to 2.18 inches.

One man can operate a battery of Revacycle machines, since it is only necessary to load blanks and remove finished gears about once an hour. The blanks are placed on the vertical spindles of the indexing table at the loading station, seen at the right in Fig. 2. Ten vertical spindles, each holding fourteen blanks, are provided on the loading table of machines employed for producing differential pinions, while on the table of the side-gear machines, there are seven spindles, each holding eight blanks.

At the start of the automatic cycle, a hydraulically actuated elevator lifts a stack of blanks on one of the spindles of the loading table. Then a pair of jaws on the scissor-head of the hydraulic swinging arm closes to grip the uppermost blank on the stack. The elevator now descends, and the loading table is indexed (one-tenth or one-seventh of a revolution) to bring the next stack of blanks above the elevator.

Simultaneously, the loading arm—with a blank gripped in the scissor-head—swings through an angle of 155 degrees to the work-head. During this movement, the blank is rotated through an angle of 90 degrees to bring its axis into a horizontal plane. When the blank reaches the work-head, it is slid onto a hydraulically operated expanding arbor. In expanding, the arbor rigidly clamps the blank for the machining operation, after which the jaws on the loading arm open.

As seen in Fig. 3, which is a close-up view with the cutter cover lifted to show the cutting action, the large-diameter cutter contains blades extending radially outward from the cutter-head. The periphery of the cutter is made up, consecutively, of eleven roughing segments, one single-blade chamfering attachment, and four finishing segments. Each of the roughing and finishing segments, made from 18-4-1 type high-speed steel,

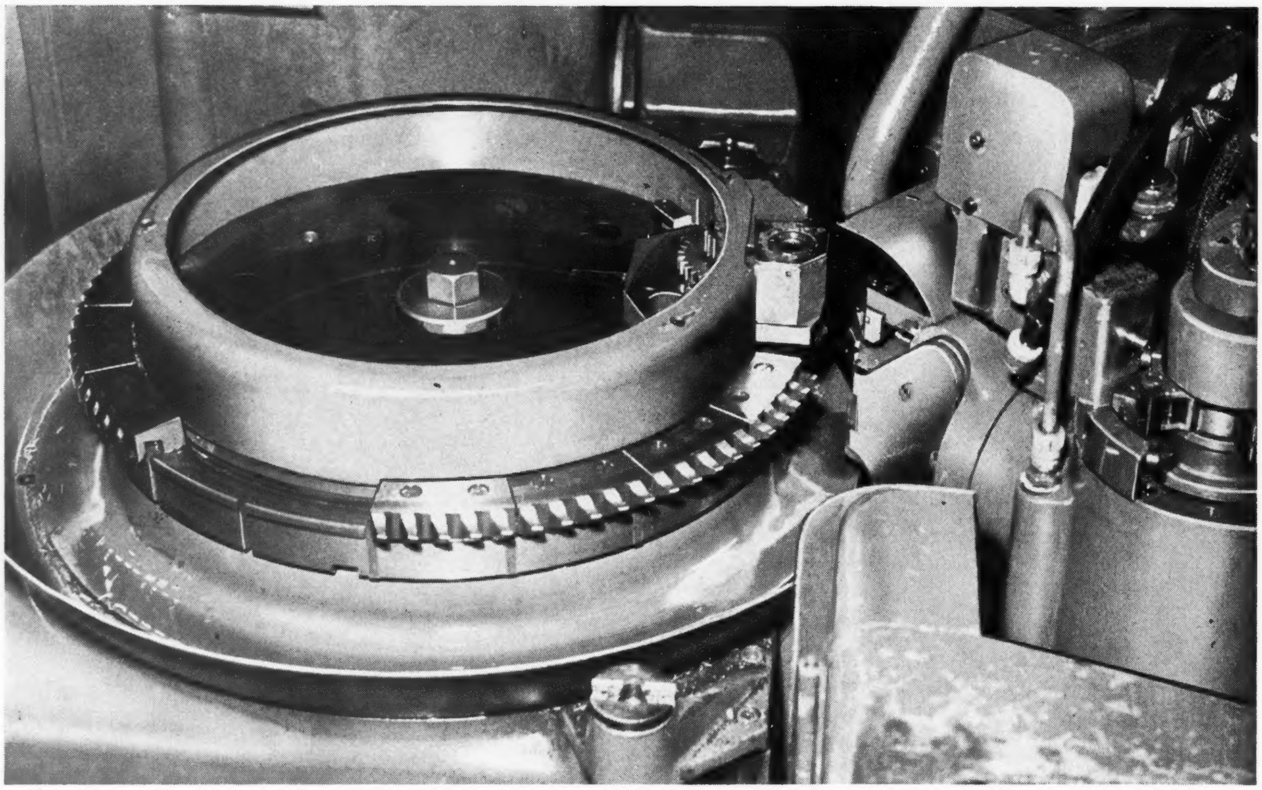


Fig. 4. A single cutter blade, seen opposite the gear blank, which is rotated by means of a sun gear in the cutter cover (not shown), removes burrs by chamfering the back-angle profile of the tooth space

contains five cutting blades. Each blade has two concave cutting edges, for forming the connecting faces of two adjacent gear teeth, and a flat cutting edge, which connects the concave edges at the periphery of the cutter to form the root between the two adjacent gear teeth.

The cutting action can be compared to circular broaching, with the first roughing blade removing a small amount of metal from the blank and each successive blade increasing the depth of cut until the final blade completes the tooth space. During rotation, the cutter is moved slightly—in a straight line across the face of the gear being cut and parallel to its root line—by means of a cam. The direction of this motion is reversed when the finishing blades pass across the blank, so that the cutter has returned to its original center of rotation at the completion of one revolution. The combined effect of this carefully synchronized rotation and translation and the specially designed contour of the cutter blades produces the desired tooth form with a straight root between the teeth.

A gap is provided on the cutter body between the last finishing blade and the first roughing blade so that the non-rotating gear blank can be automatically indexed without stopping the rotation of the cutter. The cutter rotates in a horizontal plane at a peripheral speed of 127 feet per minute, completing a tooth space on the differential side gear (at one revolution) in 2.65 seconds.

Fig. 5. Unloading station, seen at the left, contains seven vertical spindles, over which completed gears are dropped. The loading station is shown at right. Both unloading and loading tables are indexed one-seventh of a revolution in each cycle

The burring or chamfering attachment, which is located on the cutter body between the roughing and finishing blades, removes burrs from the entire back-angle profile and the bottom of the tooth space at the heel of the gear being cut. It consists of a single cutting blade, seen directly opposite the gear blank in Fig. 4, which is rotated independently by a gear train and sun gear located in the cutter cover (not shown).

When the last tooth space in the gear blank has been completely machined, rotation of the cutter is automatically stopped. The pair of jaws on the end of the loading arm then close on the completed gear, remove it from the arbor on the work-head, and carry it through an angle of 100 degrees to the unloading station, seen at the left in Fig. 5. The jaws now open and drop the completed differential side gear over one of the seven vertical spindles on the unloading table. Both the loading and unloading tables are indexed one-seventh of a revolution during each cycle so that a full load of fifty-six blanks can be completed before the operator need unload and reload.

After dropping the completed gear, the automatic hydraulically actuated arm swings back to the loading station to pick up another blank from the next stack. The complete cycle is then repeated. As previously mentioned, defective or improperly positioned blanks on the spindles of the loading table are automatically rejected without interfering with the continuous cycle. Blanks having under-size bores will be rejected in this way, while blanks with over-size bores will cause a limit switch to be actuated, thus lighting a red light and automatically stopping the machine.

Close dimensional accuracy is maintained on gears produced by this process. Tooth size is held within $\pm$ 0.001 inch, and backlash after assembly must not exceed 0.003 inch. Quality is controlled by checking the dimensions of a gear from each machine every hour. The contact areas or bearing surfaces of the teeth are inspected by running the gear in mesh with a master.

Fig. 6. Cutters for the Revacycle gear-generating machine are built up on a special stand. The multi-bladed roughing and finishing segments are secured to the cutter body by screws

The cutters are built up on a special stand, Fig. 6. The multi-bladed segments are secured to the cutter body by means of socket-head capscrews. Cutters employed for generating the differential side gears have averaged 1500 parts before sharpening is necessary, while those used for differential pinions usually produce 2500 pieces between grinds. With both cutters, approximately twenty sharpenings can be made before the set of segments has to be discarded.

European Machine Tool Exposition

A machine tool exhibition will be given in Paris, France, on September 1 to 10, 1951, under the auspices of the European Committee of Cooperation of Machine Tool Industries. The object of this committee is to establish, on the largest scale possible, an exchange of scientific, technical, industrial, and social information. The exhibit will be open not only to members of the committee, but also to other manufacturers of machine tools in Europe, the United States, and Canada. Those interested can obtain further information from European Machine Tool Exhibition, 2 Bis, Rue de la Baume, Paris (8) France.

Lyons International Fair

The annual Lyons International Fair, which covers all types of business and industry, will be held this year from March 31 to April 9 in Lyons, France. American manufacturers, business men, wholesalers, retailers, and importers will be represented, and there will also be an official display by the United States Government. Among the exhibits to be shown in the machinery division will be machines and tools for practically all industries, including machine tools, agricultural machinery, building machinery, industrial vehicles, etc. Further information can be obtained from the French Chamber of Commerce of the United States, 630 Fifth Ave., New York 20, N. Y.

Engineering News

Desk-Sized Electronic Computer Developed by Northrop

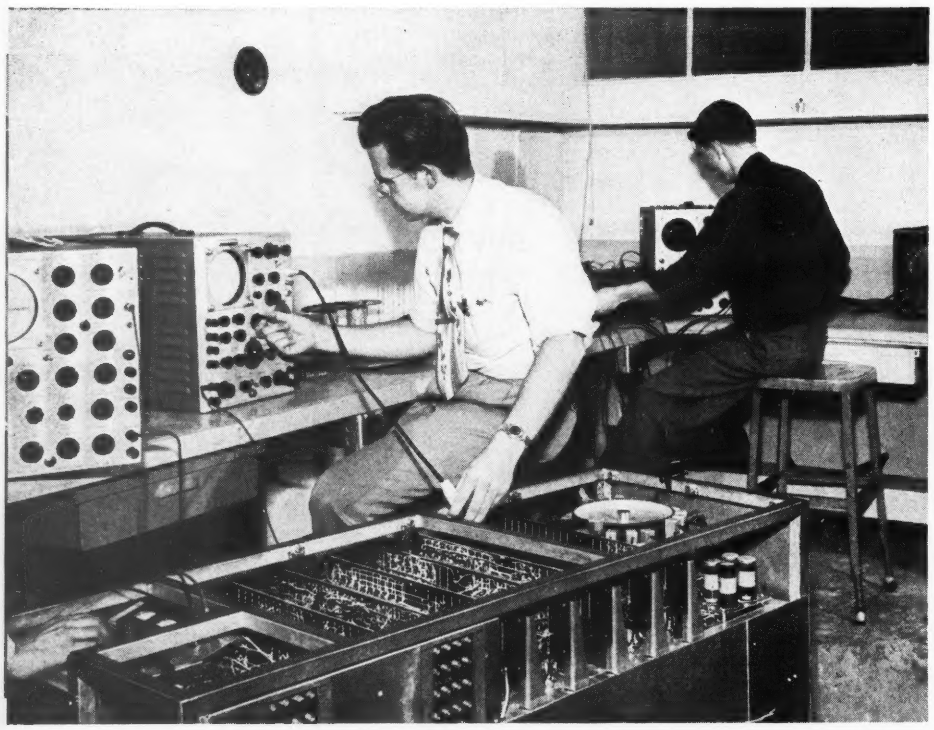
A new type of compact electronic "thinking machine" has been developed by engineers of Northrop Aircraft, Inc., Hawthorne, Calif. It is known as "Maddida," which is derived from "magnetic drum digital differential analyzer" and pronounced to rhyme with "mad Ida." The first production model was built by Northrop for the Experimental Towing Tank of the Stevens Institute of Technology, Hoboken, N. J., and will be used in determining the best designs for ship hulls and in making stability and control investigations on hydrodynamic bodies.

This digital computer can solve, in a few seconds, problems so complex that months, or even years, would be required to work them out on standard desk calculating equipment. It also evaluates information and makes decisions, operating at an accuracy of one part in 100,000,000. "Maddida" computes with less than 100 vacuum tubes (some "jumbo" size computers have as many as 18,000 vacuum tubes), and has only one moving part—a spinning magnetic drum which can store about 10,000 digits. Its compactness is due to the skillful use of electronic circuits, which enables a single circuit to do multiple tasks, and its use of mathematical short-cuts.

Autopilot Guides Jet Planes in Combat Maneuvers

What is said to be the first automatic pilot with unlimited maneuverability—an electrical "co-pilot"—has been devised to guide an all-weather jet fighter plane through loops, rolls, and other combat maneuvers with split-second accuracy. The Westinghouse Electric Corporation, in cooperation with the Air Materiel Command's Armament Laboratory, designed this midget device—one-third the weight of conventional automatic pilots—which will be installed in the F94C Lockheed fighter plane.

Three "non-tumbling" gyroscopes, rotating at 12,000 R.P.M., are "locked" to the plane and follow it during all maneuvers without any possibility of tumbling. Former gyroscopes were sensitive only to changes in angle of the plane, whereas this autopilot responds to the rate at which such changes take place, flashing its message to the control surfaces, which move to make their correction in less than one-fifteenth second. Another unique feature is the control stick, which is a single spherical-shaped metal disk or control knob that can be moved three ways to achieve the desired maneuver. The autopilot has been put through more than 60,000 test miles of banked turns, rolls, loops, and level flight.



The rapidly revolving drum of an electronic computer developed by Northrop Aircraft, Inc., can store up about 10,000 numbers reported through electronic pulses, which are kept "on tab" until needed. During the process of arriving at an answer, the computer digs into the "memory" circuit and lifts out the number or series of numbers needed for a solution. Oscilloscopes project the computer's "thoughts" on a screen of the instrument box

New Short-Circuit Current Record Made at Grand Coulee Dam

A new short-circuit electrical current record was set recently during a series of tests conducted by the General Electric Co. and the U. S. Bureau of Reclamation at Grand Coulee Dam. The tests were made on a single-pole unit of one of the thirteen 10,000,000-K.V.A., 230-K.V. oil circuit-breakers now installed in the Grand Coulee project. The generating capacity of twelve of the fourteen 108,000-K.W. generators at Grand Coulee, plus the available capacity of other stations of the Northwest Power Pool, were thrown into the tests to produce the largest value of short-circuit current ever recorded—the equivalent of 12,000,000-K.V.A. symmetrical three-phase current.

Even this enormous amount of short-circuit current was interrupted by the 10,000,000-K.V.A. circuit-breaker unit within its rated interrupting time of 3 cycles. Careful inspection after the series of tests revealed that all parts of the circuit-breaker were in condition to continue normal operation and the unit could have easily withstood many more tests of like magnitude.

Torsion Impact Machine Sensitive to Small Energy Changes

Ferrous and non-ferrous materials can be tested under torsion impact loading on a machine designed by Paul DeKoning, assistant professor of mechanical engineering at Michigan State College. This instrument is applicable in research work and in controlling manufacturing processes.

It uses the energy of a rotating flywheel to snap off a small specimen held in a special chuck. A unique feature of the machine is the simultaneous recording of torque loads and energy absorption values on the tape of a two-pen Brush oscillograph. Use is made of SR-4 strain gages with a strain analyzer for measuring torque, and a photo-cell tachometer records energy levels indirectly by means of a wave form printed on the oscillograph tape beside the torque record.

A new type of specimen is used. It has essentially a zero gage length, obtained by cutting an 80-degree vee notch around the periphery of a short piece of 1/2-inch round stock. The specimen has a flat spot on one side to allow for gripping it in the machine, and is held so that the faces of the holding chuck and twisting dog are about 1/16 inch apart. By this arrangement, a shear plane, 5/16 inch in diameter is produced in the specimen. Although the test pieces must be accurately made, they are inexpensive and easy to produce because of the relatively small amount of machining required.

The flywheel of the torsion impact machine has an initial speed of 420 R.P.M., and is of such weight as to possess an energy level of 20 foot-pounds at this speed. The combination of low energy level and low wheel velocity makes the instrument sensitive to small energy changes; hence, it is useful for checking materials on the basis of composition or heat-treatment. Values of torque and energy obtained by the test are accurate, and show the ability of various materials to resist shock loading in torsion, as well as the effect of varying compositions, heat-treatments, and operating temperatures.

Diaphragm Type Micromanometer with Electronic Pick-Up

A diaphragm type micromanometer utilizing an electronic pick-up has been developed recently at the National Bureau of Standards to measure differential pressures in the micron region. Constructed for use with a mass spectrometer, the micromanometer gives rapid, direct readings of pressure on a microammeter scale that can be calibrated directly in units of pressure. It is relatively insensitive to temperature changes, operates in any position, and permits measurements that are totally independent of the type of gas or vapor being measured.

This instrument consists of a pressure cell and an electronic micrometer, enclosed in a glass dome which can be evacuated or filled to any desired reference pressure. The pressure cell is composed of a very thin corrugated diaphragm sealed at the periphery to a slightly dished brass disk. This cell is connected to the gas sample so that a change in pressure of the gas causes movement of the diaphragm. The diaphragm movement in response to pressure variations is measured by a mutual-inductance micrometer placed above the diaphragm. Mechanical coupling errors are thus eliminated.

The manometer is capable of measuring pressures in the range of 1 to 100 microns with a sensitivity of about 0.1 micron on a 50-micron scale. Continuous use of the instrument for more than one year has shown that its sensitivity and zero point are remarkably constant. Frequent observations have disclosed variations in calibration of less than 1 micron over a twenty-four-hour period. A differential pressure of one atmosphere, applied externally on the pressure cell, has only a slight hysteresis effect, while pressures up to several tenths of a millimeter can be applied inside the pressure cell without harmful effects on the diaphragm.

Methods of Heating Laminated

Important Points to Observe in Obtaining Optimum Formability of Thermosetting Plastics, and Relative Efficiency of Various Heating Systems — Second of a Series of Articles on Postforming

By WILLIAM I. BEACH, Executive Assistant
North American Aviation, Inc.
Los Angeles, Calif.

IN a previous article (see MACHINERY, February, 1951, page 163), some of the forming characteristics of fully cured, or "C" stage, thermosetting laminated plastics were described. The thermal properties and the effects of different temperatures and heating times on this material will be described here, and a brief comparison will be made of the principal types of heating units.

In order to satisfy the requirement for optimum formability, it is extremely important to understand the behavior of thermosetting plastic laminated sheets under forming conditions. Inherently, these materials, as the term "thermosetting" implies, are heat-hardening. Such materials, although fully cured, or polymerized, during the initial manufacturing step, possess a well of residual plasticity which, when sufficiently tapped, enables them to be deformed or shaped under controlled procedures and within definite limits.

The relation of this phenomenon to heating time and temperature is an exacting one. Prolonged heating in the forming range alters the properties of the plastic sheet due to internal chemical changes.

Softening versus Hardening and Blistering Effects

The length of time during which the material can be heated in the forming temperature range without hardening excessively depends upon the heating methods employed; but it may be assumed that, in general, this time will vary inversely with the softening temperature; that is, the lower the forming temperature, the longer the time the sheet may be kept at this heat without suffering excessive cure. Conversely, the degree of softening or plasticity obtained is directly proportional to the intensity of the heating medium.

Another result of prolonged heating may be blistering or local delamination of the surface. Blistering is caused by the formation of gas in pockets within the part, the pressure of which is sufficient to result in the surface layers of the laminated stock separating locally in the manner characterized as blisters. When heating of the plastic material occurs by conduction from without, the relation between softening temperatures, curing rate, and surface temperature determines the maximum thickness of plastic

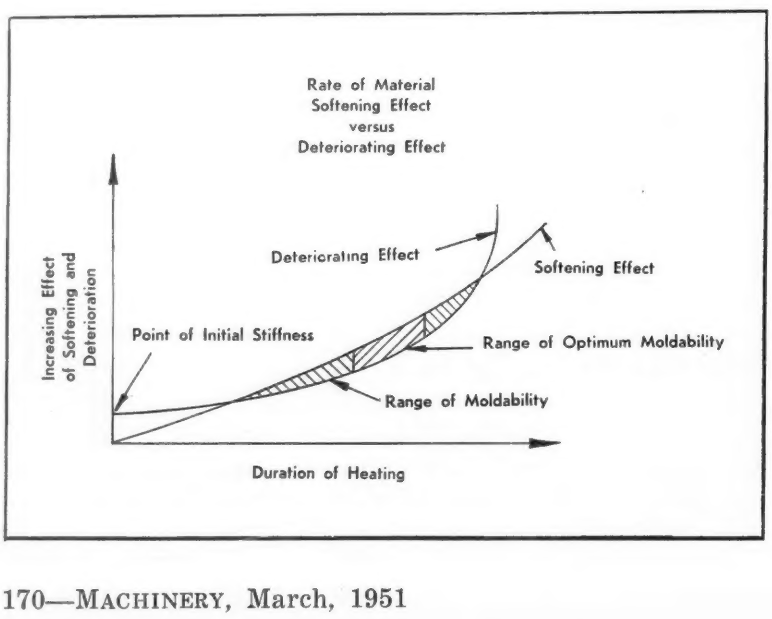


Fig. 1. Curves showing the joint influence of softening and hardening effects on the formability of thermosetting laminated plastic material

Note: The Postforming Process is covered by United States and foreign patents, and pending applications are assigned to North American Aviation, Inc.

Plastics for Postforming

sheet stock that can be brought from room temperature to forming temperature in heating equipment of any given capacity.

Rate of Softening and Hardening Relative to Temperature and Time of Heating

Results of experiments show that no appreciable reduction in initial stiffness (non-formable condition) takes place until the internal temperature of the material has been raised to the point where a softening effect is observed. The plastic sheet is pliable at this temperature; but a secondary effect, deterioration or hardening, also takes place, reducing the effective moldability. If heating is prolonged, the hardening effect increases at a faster rate and rapidly overtakes and absorbs the softening effect.

At a higher temperature setting, the initial rate of softening is greater than that of the hardening effect, and the plasticity of the material approaches the optimum. The moldable range becomes increasingly wider with each increment of temperature rise, but, corresponding to a definite pattern, the hardening effect, with prolonged heating, again ultimately overtakes and cancels the softening effect.

With increasing internal temperature settings up to the blistering temperature, the material is at, or near, its optimum formability state. While the material apparently gets extremely limp and more pliable with each increment of temperature rise, the moldability range tends to narrow again near the blistering point.

This indicates that at higher temperatures, the slope of the deterioration effect curve becomes increasingly steeper, and will undoubtedly intersect the softening effect curve somewhat in the unexplored range beyond the blistering temperature. Experimental, as well as production, results seem to substantiate this conclusion.

An interpretation of corresponding chemical changes taking place in thermosetting material during any given time-temperature cycle may be explained more clearly by referring to non-dimensional curves (Fig. 1) plotted to represent the joint influence of softening and hardening effects upon material formability. The curve shown in Fig. 2 indicates the moldability range.

Forming Efficiency and Performance

Having a working knowledge of the thermal behavior of the material to be handled, the next step is to understand its reaction to surface heat-

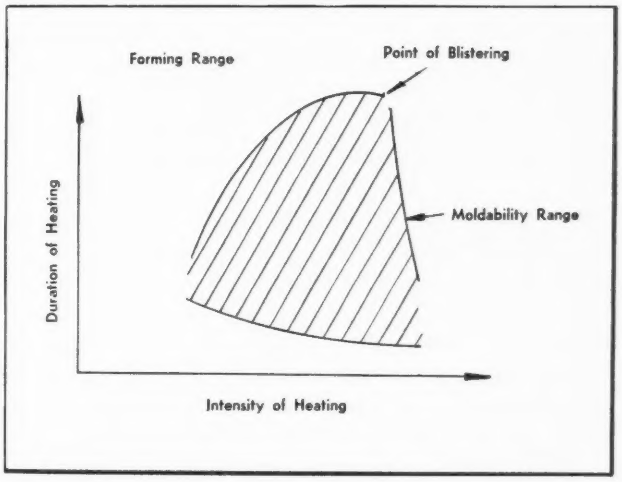


Fig. 2. Curve showing the moldability range of thermosetting laminated plastic material in relation to the heat intensity and length of heating time

ing. A logical choice of a heating system is one having large heat transfer coefficients. For maximum efficiency of operation, considering material processing and economy of production, it is essential to select operating conditions that minimize material deteriorating effects evident in slow heating systems.

For example, with materials having low thermal conductivity, temperature gradients will arise within the mass, due to the relatively higher thermal resistance of the interior in comparison to the surface resistance. The average magnitude of the internal and surface temperature gradients with respect to time and the intensity of the heating media is an approximate measure of material forming efficiency.

In actual practice, when the heat transfer is slow, the material will respond to incremental or cross-sectional changes of softening and hardening in accordance with the conditions previously stated. The surface, being immediately exposed to the heating media, will reach its optimum softening condition much sooner than the innermost section. If an attempt is made to form the material when the surface has reached this condition, the moldability value will lie somewhere between one-half and two-thirds of its potential maximum.

By the same token, if prolonged heating is attempted as an alternate to equalizing temperature gradients, the time lag will allow the surface to exceed its optimum softening stage and a corresponding hardness to set in. Furthermore, to speed up the softening process, it is necessary to operate at higher and more critical

temperatures. Heating temperatures higher than the critical blistering temperature of the material reduce the scope of the moldability range, and hence limit actual working operations. Under normal circumstances and with controlled timing, the blistering factor need not seriously affect production.

Comparison of Heating Systems

The choice of the best heating system to employ for softening laminated plastic sheet depends upon specific production requirements, as well as the most economical means available for generating uniform heat within the sheet stock. An evaluation of specific heating methods is given here for purposes of comparison.

The hot air circulating oven system is the cleanest of the methods using fluid heat-transfer media. This method is so slow, however, that in heating thick pieces, there is danger of heat-hardening the surface, due to internal chemical changes occurring during the long time required to bring the piece to the temperature where it would normally soften, unless the air is kept at a temperature higher than is practical for thinner pieces, in which case surface blistering would limit the performance.

The heat-transfer coefficient in a hot oil bath method is roughly tenfold greater than in an air convection oven. As a result of the faster heating rate, the danger of excessive chemical reactions occurring during the heating of thick pieces is less than when heating with air. However, heated oil baths create production and personnel problems in that care must be taken to avoid fire, and the presence of oil on the parts involves an extra production operation in degreasing or wiping them clean.

A molten-metal bath has the advantage of possessing the greatest heat transfer coefficient of all fluid media. In fact, the values are so large that the surfaces of the plastic sheets being heated may be assumed to be at the temperature of the bath during the entire heating period. As a result of this condition, the heating times are dependent solely upon the thermal conductivity and thickness of the plastic and upon the temperatures to which it is exposed.

The disadvantages of this system are similar to those of the oil bath; in this case, the molten metal in cooling, freezes and clings to the parts, so that they have to be cleaned after completion of the forming process. If small metal particles are left clinging to the faces or embedded in the rough edges of the sheet, they will indent and mar the surfaces of the dies while the forming operation is being performed.

Softening the sheet between the surfaces of heated platens may be regarded as satisfactory for certain thicknesses and sizes of sheets. This is an excellent method to employ if sheets of only one thickness are to be heated in a given period of time. However, it is unsatisfactory for handling sheets of varying thicknesses during the same production period in a single press. Since the time required to make the necessary temperature changes in the platens would be great, production would be delayed.

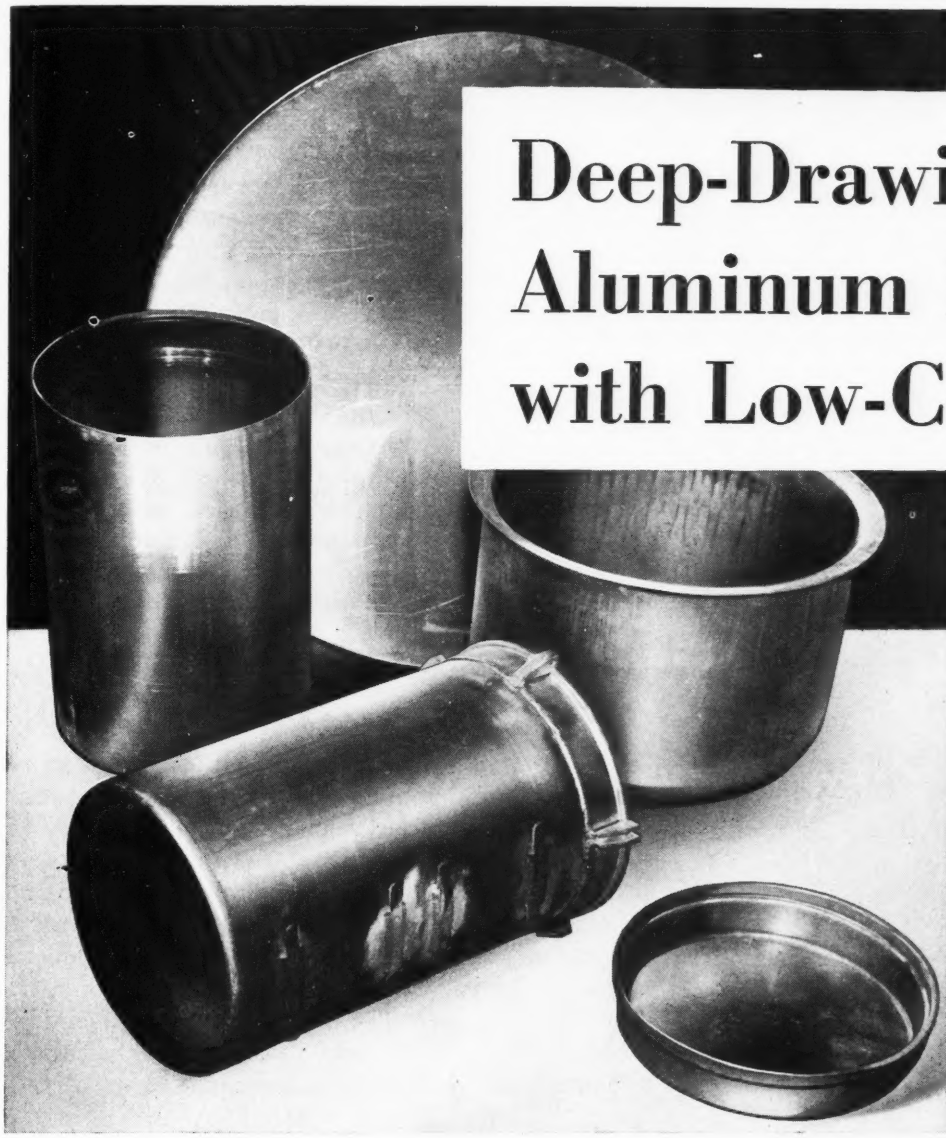
Infra-red ovens appear to offer a considerably greater degree of flexibility in operation than any of the previously mentioned systems because this type of heater may be designed to be controllable. A conveyor moving at a uniform velocity, carries the parts through the oven and discharges them at the required forming temperature, regardless of variations in thickness. This is accomplished by selectively extinguishing some of the lamps when heating thin pieces and turning on more lamps when heating the thicker ones. By using a fully enclosed oven, with air maintained at the softening temperature of the plastic, it is possible to obtain energy efficiencies about equal to those with other equipment, and at the same time, have a fairly compact unit which will deliver clean, dry parts at the fast production rate required.

High-frequency electrostatic heating is the best method known for rapidly heating thick pieces of material having low thermal conductivity. Adjustments can quickly be made for handling sheets of varying thicknesses in the same production period, so that this factor should cause less difficulty than with other methods. Furthermore, only by this method is it possible to heat pieces as thick as 1/2 inch to forming temperatures within the desired heating time.

* * *

Management Course Offered by Iowa State University

The College of Engineering, State University of Iowa, announces the twelfth summer management course for factory managers, foremen, industrial engineers, and methods and time study analysts, to be held June 11 through June 23. The subjects to be covered will include production planning; job evaluation; motion and time study; wage incentives; plant lay-out; quality control; supervisory training; labor relations and legislation; organization and policy; and public speaking. Communications concerning the course should be addressed to J. Wayne Deegan, State University of Iowa, Iowa City, Iowa.



Deep-Drawing Aluminum Parts with Low-Cost Dies

By
EMILIO ANDREOLA
Manufacturing Engineer
Sperry Gyroscope Co.

ONE of the most useful machines in the pressed-metal department of the Sperry Gyroscope Co.'s plant at Lake Success, N. Y., is a 150-ton H-P-M Fastraverse double-action hydraulic press equipped with a hydraulic blank-holder and die cushion. This machine, shown in Fig. 1, which was purchased primarily for deep-drawing large parts, has not only been highly successful in such work, but is employed to advantage also for smaller drawing jobs.

Some of the parts in the latter class are square or oblong in shape, and have rather small corner and bottom radii, especially for light-gage parts. Yet they are drawn from aluminum with almost negligible scrap, and often require fewer operations than when produced on mechanical presses. This is attributable to the easily controlled rates of draw at pressures selected to suit the particular part.

Another extremely important feature of this press is that the blank-holder pressure can be quickly varied, but precisely maintained, during the drawing operation. Each corner of the blank-holder slide can be independently adjusted for the desired pressure.

About one hundred jobs varying greatly in depth of draw, projected area, and gage of metal have been undertaken up to the present time with marked success. The largest requires the full capacity and stroke of the press, but since the press is not often needed for maximum capacity jobs, it is frequently applied to smaller work. Certain of these operations require bulging, which is accomplished by the use of rubber, but in nearly all cases, an inexpensive Kirksite (zinc-alloy) die, a low-cost cast-iron punch, and a soft steel blank-holder are used. The ease with which the Kirksite can be remelted and used over again is an additional contribution to the economy of the operation.

Thus far only parts made from 2S-O, 3S-O, and in a few cases, 52S-O aluminum sheet have

Fig. 1. Hydraulic press of 150 tons capacity, equipped with a hydraulic blank-holder and die cushion, is advantageously employed for deep-drawing both large and small aluminum parts

been produced, although it would be feasible to draw parts from light-gage stainless steel, and this application is being contemplated. The Kirksite dies and cast-iron punches are not only moderate in cost, but have worked better than hardened steel for the quantities needed, because the latter tends to gall the aluminum, and neither Kirksite nor cast iron is subject to this fault.

What is thought to be something of an innovation in the set-up is the use of steel shims, ground to the same thickness as the sheet metal to be drawn, which are laid on the top face of the Kirksite die, just outside the blank. When the blank-holder is advanced, the steel shims prevent the aluminum blank from being gripped with undue tightness between the pressure ring and the die face. Yet these parts close tightly enough to prevent the flange, when one is left on the piece, from wrinkling, and wrinkles on drawn walls are minimized. Any slight variations in blank thickness appear to have no significant effect when the shims are used.

In general, runs in this plant are not over 300 pieces for each set-up, and the average total production of parts is 1250. Economical production on such short runs makes fast and sure set-up of the press vital and also makes it essential to keep die costs low.

The use of Kirksite and cast iron accomplishes the latter result, partly because both are cast fairly close to size and can also be machined freely. It has been found best to core die cavities to such a size that about 1/2 inch of Kirksite is machined off, since the surface layers have some porosity, which prevents the cavity from being finished to a highly polished surface.

The largest of the drawn parts produced is the pressure housing shown completely assembled in the heading illustration, along with the blank and the drawn components. The blank is 3S-O aluminum sheet (soft temper), 0.081 inch thick and 28 1/2 inches in diameter. In the first draw it is converted into a flanged shell measuring 14 1/2 inches at the inside diameter and 13 inches deep. The bottom is drawn to a radius of 9.312 inches, and the curved surface is joined to the side walls with a 1-inch radius. A pressure of 65 tons is applied to the punch, and 10 tons to each of the four rams on the blank-holder in this draw.

Fig. 2 shows the shell being redrawn to the finished size. In Fig. 3 the shell is seen after the redraw, when the inside diameter is reduced nearly 30 per cent to 10.187 inches, plus 0.031 inch, minus zero. The pressure on the punch during this draw is 60 tons. The radius of the curved bottom surface remains unchanged, but the 1-inch corner radius is reduced to 1/2 inch at the junction of the bottom with the side walls. As drawn, the shell is 18 inches deep, but it is trimmed to 17.562 inches, plus 0.031 inch, minus zero. The thickness of the metal actually increases about 0.010 inch in the two drawing operations.

In Fig. 4, the hollow cast-iron punch used in the first draw may be seen, and back of it the Kirksite die and steel pressure ring employed with it. The punch is made of Grade A Meehanite, and the die ring of Kirksite supported on an aluminum base. Boiler plate, machined and polished, is employed for the blank-holder.

The punch and die materials used for the second draw are the same as for the first, and a Masonite spacer block, which further reduces the die cost, is employed, as shown in the assembly illustrated in Fig. 2. Besides drawing the main shell of the pressure housing, it is necessary to produce a drawn reinforcing gasket ring (seen at lower right in heading illustration) that fits around the open end and is later welded in place, as shown in the assembled view.

This ring is first drawn as a shallow cup with

Fig. 2. Start of the redraw of a 14 1/2-inch diameter shell, using a Kirksite die and a cast-iron punch. The shell produced measures 10.187 inches inside diameter and is 18 inches deep. The reductions made in the first and second draws are nearly 50 and 30 per cent

Fig. 3. Removing the 18-inch deep shell from the second drawing die shown in Fig. 2. Cups seen in the tote box are ready for second draw

a stepped diameter near the top, as shown in the drawing Fig. 5. This step requires a vertical section through the die. In this case, a forged-steel punch and die are used in order to stamp the sharp offset, but the blank-holder is cast from Kirksite.

The blank for the ring is made of soft-temper 52S aluminum alloy and is 13 7/8 inches diameter. It is drawn in a single operation, despite the short radii next to the step. The bottom of this cup is cut off, of course, before the ring is welded to the housing. In making this draw, a pressure of 40 tons is applied to the punch and a pressure of about 12 tons to the blank-holder.

While none of the other parts produced on this press are as large as this housing, many others are deeply drawn and some are exceptionally thin for draws of the depth attained and for the small radii at the corners and bottom. A typical group of parts produced on the H-P-M Fastraverse press are shown in Fig. 7.

Of these parts, one of the most interesting is the Gyrosyn cover *F*, the dimensions of which are shown in the drawing Fig. 6. Some of these covers are of a symmetrical hat-like shape, but others require a bulge at one side of the crown. Both types are produced in the die illustrated in Fig. 9. Most of the major parts of the die, as well as the punch, are Kirksite castings. In cases where a bulge is required on the drawn cover a removable steel insert is added to the punch for producing this shape. When no bulge is wanted, an insert that completes the symmetrical dome shape of the punch is applied.

The Gyrosyn covers are produced from 2S-O aluminum sheet blanks, 0.051 inch thick, in a single draw. Prior to using this hydraulic press, the covers were spun, and the unsym-

Fig. 4. Lifting the punch used for the first draw of the pressure housing shown in the heading illustration from a wooden holder. At the left is the mating drawing die and its blank-holder ring

metrical bulge was produced in a die. Occasionally, with this method, tearing occurred at the bulge, so that the hydraulic press with its controlled draw provided a real advantage.

In some applications, these Gyrosyn covers require a flange of double thickness, as shown in Fig. 6, and sometimes a ring is inserted between the two thicknesses. In such instances, a larger blank is used, and the wider flange is redrawn to provide a collar at right angles to the flange plane. Then the collar is spun down to make the double-thickness flange, the extra ring being inserted first, if specified. Naturally, the parts are produced much faster in this way than when the entire piece was spun.

Among the small parts of oblong section produced from 2S-O stock, 0.040 inch thick, is the amplifier case *H*, Fig. 7, having bottom corners of only 1/16 inch radius and side corners of 3/32 inch radius. The inside dimensions are held to limits of plus 1/64, minus 0.000 inch. This part is produced in three draws with very low scrap loss. Before this press was used, five draws were required, and even then scrap ran high.

A similar part is produced from still thinner (0.032 inch) 2S-O aluminum stock in three draws on the hydraulic press, where five draws were formerly required and much higher scrap loss occurred. While such parts are small for a press of this capacity, because of the superior work it does and the fact that the number of parts is small, its application for this job cannot be considered uneconomical.

Fig. 8 illustrates a die used in producing a nearly square can in a single draw. The can, as well as the 0.051-inch thick 2S-O blank used, may be seen in front of the die. The corner and bottom radii are 3/8 inch, and the depth of draw is over ten times the corner radius. The corners of the blank are clipped off as shown, and it is coated on both sides, except at the center, with a drawing compound of heavy consistency made by mixing 1/2 pound of Fiske No. 189 compound in one pint of No. 10 Fiske drawing oil.

The dimensions of the drawn part are 4 31/32 by 4 29/32 inches, and the draw is 4 inches deep. Later, the can is trimmed to a depth of 3 21/32 inches. Cast iron is used for the punch, and the die is made of Kirksite. No significant die wear has occurred in producing 1000 drawn parts in this die.

As may be seen in Fig. 7, parts *E*, *G*, and *K* are drawn much deeper than parts *H* and *J*, to which reference already has been made, but it is not necessary to make more than two or three draws on the hydraulic press to attain these depths and still keep scrap losses low, at the same time holding comparatively close dimensions for stamped parts.

Other examples shown in Fig. 7 make it apparent that the hydraulic press is also useful for shallow to medium draws. Part *B*, for example, involves only a shallow draw, but has stiffening ribs embossed in the bottom by the drawing stroke of the punch.

A cover *D*, about 9 7/8 inches square by 4

inches deep, is produced from 0.051-inch 2S-O aluminum in a single draw with diagonal ribs embossed in the bottom at the same stroke. In this draw, a 5/16-inch radius is produced next to the flange, which is reduced to 1/16 inch, as specified for the finished part, by restriking in the same die equipped with an extra ring below the flange for this purpose. The die employed is made principally of Kirksite, as are most of the punch and the blank-holder.

This cover was formerly fabricated from sheet stock, the developed blank being notched on a punch press. Sides, ribs, and flange were formed on a power brake. The sides and flange were then welded to make the cover water-tight. All welds had to be finished smooth and all distortion caused by welding removed. The total time for these operations per piece averaged about 1 1/4 hours. With this method, it proved to be rather hard to hold the dimensions within the desired limits.

Compared to this, the drawing and restrike operations average about five minutes per piece, including set-up time, handling, and lubricating with drawing compound. All pieces produced in the die are substantially exact duplicates, and the dimensions are easily kept within the specified limits. Time savings of this order justify both the cost of dies (which is moderate) and the press investment, especially since a better product is obtained.

Unusual in some respects is the louvered cover which is shown at *C*, Fig. 7, before the louvers are slit and formed. Initially, this piece is drawn to a rectangular shape, 13 1/8 inches long by 7 5/8 inches wide by 4 1/16 inches deep, after trimming.

Bulging of the side recesses is done in a cast Kirksite die, using a composite punch. The lower end of the punch is a Masonite block, 1 1/2 inches thick, which is a slip fit inside the drawn shell. Above the Masonite is a block of rubber of 60 to 70 Durometer hardness, cycle-welded to a steel plate above. When the punch bottoms in the shell, the rubber fills that portion of the shell above the

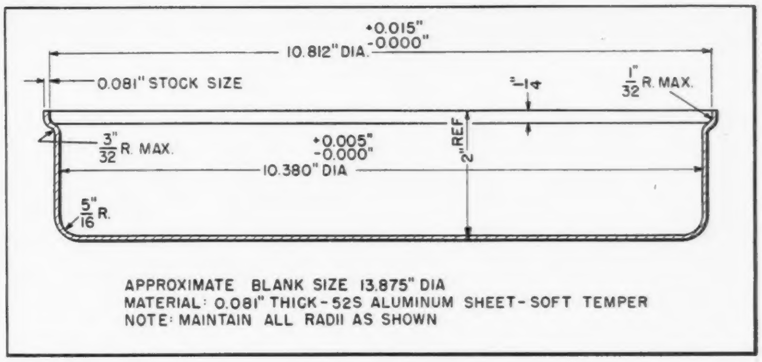
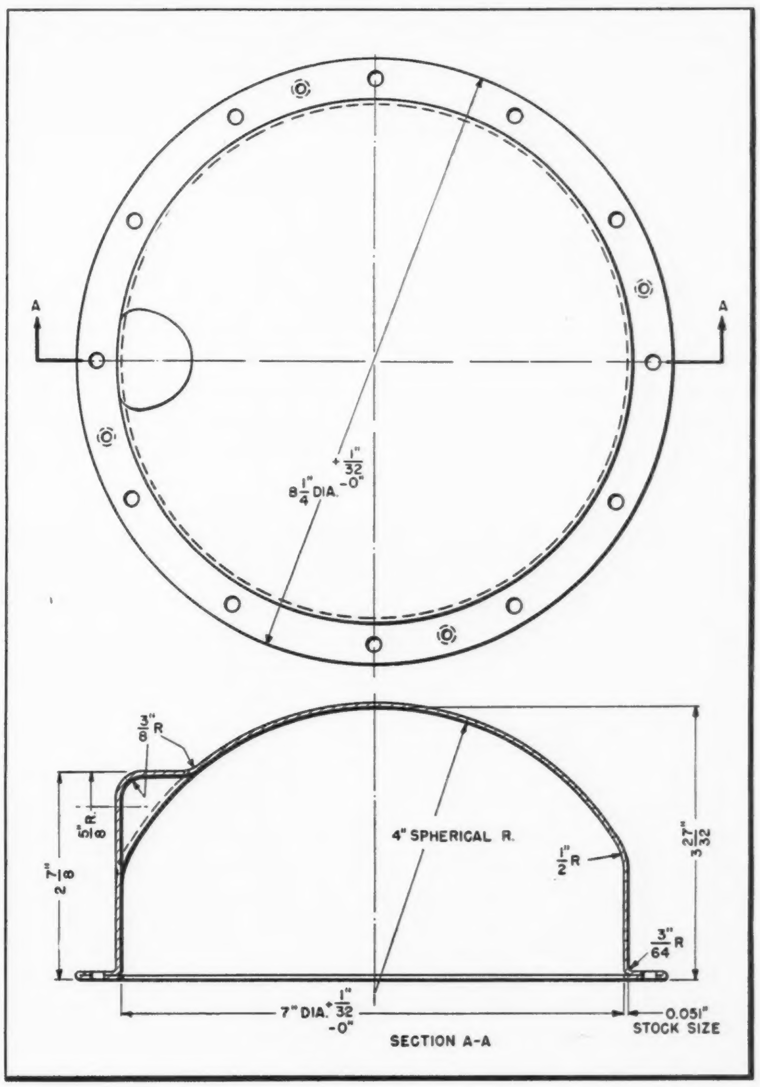


Fig. 5. Stepped ring that is subsequently welded to the open end of the pressure housing shown in the heading illustration. This part is produced from soft-temper, 52S aluminum sheet, 0.081 inch thick, in one operation

Fig. 6. Gyrosyn cover drawn from 0.051-inch thick 2S-O aluminum in a single operation, including the bulge. The flange is redrawn and then is spun back in order to provide double thickness



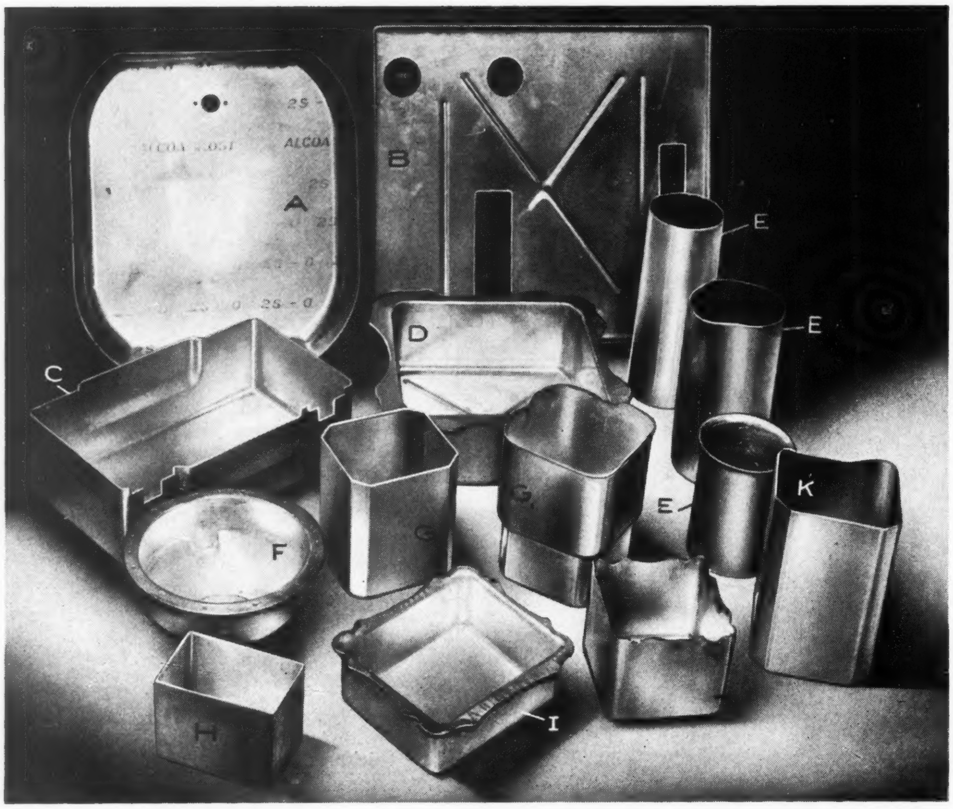


Fig. 7. All of these parts are drawn from aluminum. Several require only a single draw, and none requires more than three draws

Masonite, and pressure on the rubber causes it to bulge and form the two side walls of the shell into die recesses provided for the purpose.

Slitting and forming of the louvers and trimming of the top contour are accomplished in separate operations on other machines. In this plant, most drawn parts are trimmed to length on a router, as the quantities handled are generally too small to warrant the expense of trimming dies, and routers do the job quickly.

Another unusual part is the eight-sided cover illustrated at *K*, Fig. 7. This part is drawn to a depth of 7 1/2 inches from 3S-O stock 0.040 inch thick. The piece is shown at *K* as it appears at the end of the third draw and before being trimmed to length, a shorter trimmed part and a partly drawn part being seen at *G* and G_1, respectively.

The major dimensions are held within limits of plus or minus 0.005 inch, the 45-degree angles are held to plus or minus 2 degrees, and the radii, where the narrow sides join the wide ones, are 5/16 inch, the bottom radii being 1/4 inch.

The die used for the first draw on this part is made of steel, that for the second draw of Meehanite, and the one for the final draw of

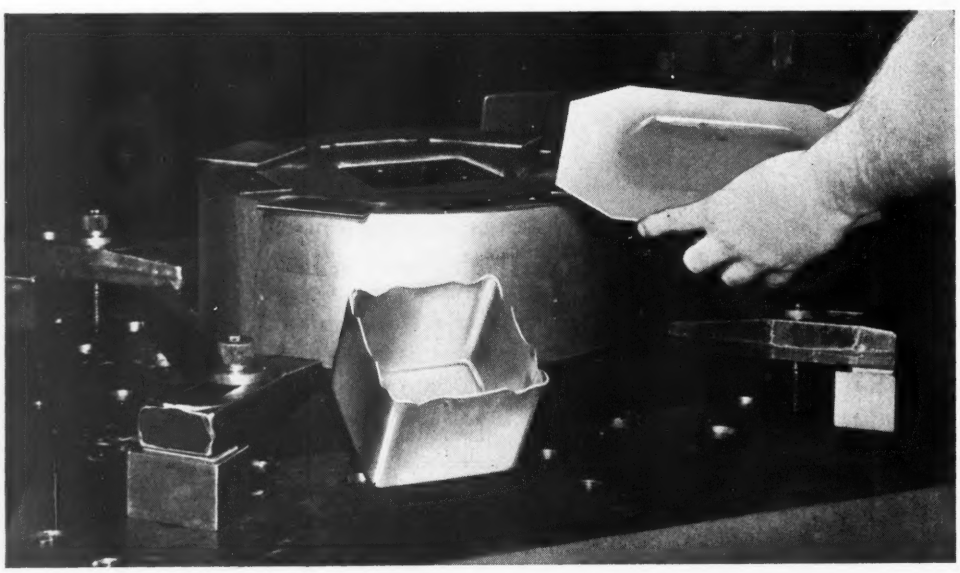


Fig. 8. Press set-up for drawing square can shown in the foreground. Shims on the face of the Kirksite die, surrounding the 0.051-inch thick blank and of the same thickness, are provided to prevent the blank from being gripped with too great a pressure

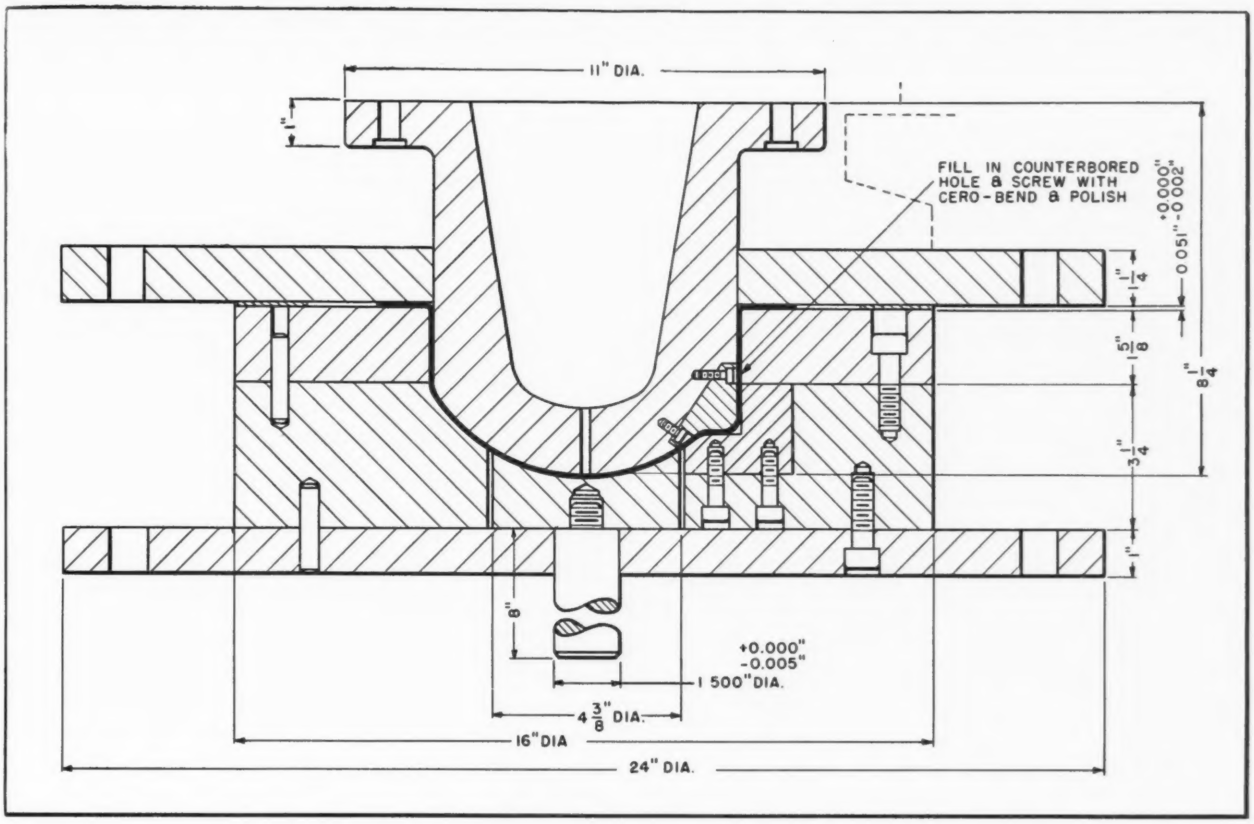


Fig. 9. Assembly drawing of the die that draws Gyrosyn covers such as illustrated in Fig. 6. A steel insert on the Kirksite punch produces the bulge, when specified, but is replaced by another insert when covers without a bulge are to be made

Kirksite. The punches are of steel or cast iron. The pressure applied to the punch is 30 tons for the first draw, 25 tons for the second draw, and 25 tons for the third draw. No annealing of the stock is necessary between draws.

The example seen at *A* in Fig. 7 is a cover produced in a single draw from 2S-O aluminum sheet 0.051 inch thick. Outside dimensions, including a narrow flange (3/64 inch wide after trimming), are 14 5/8 inches wide by 15 15/32 inches long by 2 7/8 inches deep. The radius next to the flange is only 1/32 inch, this being the radius on the draw-ring.

Production of many other stampings might be described, but the examples given are indicative of the utility and versatility of the hydraulic press employed. The versatility of the press is due to the ease with which the speed, stroke, and pressure can be adjusted to suit the die and the part to be run. Pressure control protects the soft dies, and speed control keeps down breakage, even on draws well beyond what are considered normal limits. The ability to make these adjustments without experimenting obviously contributes to the economical production of "short order" runs.

Pratt & Whitney Burr Resharpening and Salvaging Service

The critical shortage of tungsten and cobalt used in the manufacture of carbide has already affected the production of carbide burrs. It is therefore more important than ever to have dull burrs resharpened. To meet this need, the Pratt & Whitney Division Niles-Bement-Pond Co., West Hartford 1, Conn., has instituted a burr resharpening service, which is available not only to users of P & W Kellerflex carbide and high-speed steel burrs, but also to users of similar tools made by other manufacturers. Plants taking advantage of this service not only will aid in the tungsten and cobalt conservation program, but will also find that substantial savings can be realized by salvaging their worn burrs. Most burrs can be resharpened many times.

* * *

More than 48,000,000 motor vehicles comprise America's highway transportation fleet, including nearly 40,000,000 passenger cars, 8,500,000 trucks and 220,000 motor buses.

Brazing and Bronze Welding

Because of its Dependability as a Means of Repair, Bronze Welding Rod has been Widely Employed to Salvage Damaged Machine Castings and Other Machine Members that Might Otherwise be Discarded. In Recent Years it has also been Increasingly Used as a Manufacturing Tool. Typical Applications of Brazing and Bronze Welding for Both Types of Work are Described Here, and an Outline of Recommended Practice is Given

By GEORGE H. DeGROAT

IN many cases, repairs made in cast iron and other materials with bronze welding rod are stronger than the original construction. Such repairs extend the life of machines that might otherwise have to be scrapped after being severely damaged. For this reason, bronze welding rod has found wide employment in repairing large cast-iron and steel frames of heavy machines, as well as gears and other machine members that must withstand shock and severe usage.

The term "bronze welding" is employed loosely to refer to the joining of metals by the use of various copper-base alloy welding rods, although it actually applies only when both the parent metal and the welding rod are molten. This condition exists when silicon-bronze parts are joined with welding rod of a similar composition. The term "braze welding" should be used in referring to the joining of cast iron or steel with bronze welding rod, because the parent metal, which has a much higher melting point than the rod, is heated only to a temperature sufficiently high to permit the bronze to adhere to it. This "tinned" surface is then built up with additional molten bronze.

Inasmuch as brazing is accomplished at a temperature far below the melting point of the parent metal, this process offers many advantages. Owing to the fact that the surface of the parent metal is heated to only about 1290 degrees F., the danger of cracking or distortion and brittleness of the repaired sections is avoided. Thus elaborate and costly preheating, followed by slow cooling, is unnecessary. Also, complete dismantling of a machine for making repairs is often eliminated, so that much valuable time is saved.

Metals suitable for joining with bronze welding rod, in addition to those already mentioned, include wrought iron, galvanized iron, nickel, Monel metal, copper, high-copper brasses, and cupro-nickel.

An example of brazing may be seen in the heading illustration, where the pusher bracket of a rolling mill is shown being repaired. In this operation, a manganese-bronze welding rod, which melts at approximately 1600 degrees F., is used with an oxy-acetylene torch. It may be noted that the pusher bracket has been brazed in several other places, where it was previously damaged as the result of heavy loads. The fact that these brazed joints are still intact while the bracket has failed in a new place indicates that the soundness and strength of the repaired joints are greater than that of the bracket.

Another example of a repair job is illustrated in Fig. 1. A vertical shear used for cutting brass rods up to 1 1/2 inches in diameter was broken at a point on the frame where considerable load

in Maintenance and Manufacture

was imposed on it. It was repaired in approximately thirteen hours with 85 pounds of manganese-bronze rod. This saved replacing a 3000-pound casting, which would have required weeks.

The repaired furnace illustrated in Fig. 3 represents another typical example of the advantages gained by brazing. In this case, the cast-iron shell of the furnace was accidentally broken in such a way as to prevent tilting the furnace to pour out the charge of molten brass with which it was filled. An overhead crane was employed to lift the furnace out of its housing and set it on the floor, where the broken section was immediately brazed, while temporary power lines kept the molten contents of the furnace from solidifying.

Although torch brazing is generally used where the quantity of parts to be brazed is small, furnace brazing, with or without controlled atmospheres, has proved an economical method of making strong joints. With this process, copper and, in some cases, bronze welding alloys of wire or strip are used in the form of rings on flat pieces.

In addition to being damaged, machines and equipment suffer from wear. The building up of worn surfaces with bronze may add years of service life to gears, bushings, pistons, etc. Moreover, bronze provides the advantage of a low coefficient of friction for applications involving rotating or sliding parts made of steel or iron. Besides building up worn parts, sections are often reconstructed, as shown in Fig. 2. Here, lugs are being built up on clutch plates for a wringer roll. In subsequent operations, the lugs are drilled and tapped. In this example, also, a manganese-bronze rod was employed with an oxy-acetylene torch.

As a manufacturing tool, bronze welding is important for fabricating structural shapes made of steel and for permanently joining steel parts used in the manufacture of industrial, agricultural, and other equipment. Large tanks and flues, for example, formerly made from sheet steel or riveted copper, are now widely made of non-rusting silicon-bronze sheets and plates, joined together with silicon-bronze welding rod. An example of this type of work may be seen in Fig. 4, where a screen vat for the paper industry is shown being fabricated from silicon-bronze plates by carbon-arc welding with silicon-bronze rods.

The preparation of the parts to be joined is most important in all welding or brazing operations, as it greatly affects the adherence and

Fig. 1. The broken frame of a vertical shear was repaired with manganese-bronze rod in thirteen hours. This 3000-pound casting would have taken weeks to replace

Fig. 2. Building up lugs on clutch plates for a wringer roll by employing manganese-bronze rod with an oxy-acetylene torch

Fig. 3. The broken cast-iron shell of this electric furnace was repaired by brazing while a charge of molten brass in the furnace was kept from solidifying by temporary power lines

strength of the joint. Sand-blasting or metal-grit blasting is recommended for cleaning the surfaces preparatory to joining, since these methods clean inaccessible places more thoroughly than most other processes.

In repairing iron or steel castings under 1/4 inch thick, it may not be necessary or desirable to prepare a V-groove. Where a V-groove is used, however, it should be made by beveling the edges to be joined through the entire thickness of the metal, using a 60- or 90-degree included angle with the two sides of the vee separated at the bottom approximately 1/32 inch. The bevel should be cleaned thoroughly, and rust, scale, and other foreign matter removed for at least 1 inch from the edge of the bevel.

Where possible, the work should be placed in an inclined position and the weld made upward to prevent the molten metal from flowing ahead of the rod. The flux employed should be one that is especially prepared for the material to be welded or brazed, and, of course, it is essential to select a welding rod that is best suited for the particular job being handled. While there is some difference of opinion as to the type of flame best suited for braze welding, the Welding Handbook recommends an oxidizing flame. For silicon-bronze welding applications, it is general practice to employ a neutral to slightly oxidizing flame.

Carbon-arc welding with silicon bronze is usually employed in the fabrication of tanks, boilers, automatic heaters, etc., made up of copper-silicon sheets, because it is a speedy and highly satisfactory process. When a filler rod is used, it should be slightly larger in diameter than the thickness of the metal to be welded where thin sections are involved. A back-up plate of copper will conduct the excess heat away and will retain the molten metal which, when solidified, forms a stiffening rib.

Metallic-arc welding with either bare or coated silicon-bronze electrodes is also very satisfactory for this type of work. Reverse polarity is recommended in welding with direct current. Slightly greater depth of penetration is obtained with coated electrodes when a short arc is held. The metal is deposited in large globules when

Fig. 4. A screen vat used in the paper industry is fabricated from silicon-bronze plates by carbon-arc welding with silicon-bronze rods

bare electrodes are employed, and, as a consequence, it is desirable to maintain a medium long arc.

In the oxy-acetylene welding of thin silicon-copper alloy sheets, the same preparation as for carbon-arc welding is required. Flux should be applied to both the edges of the metal and the welding rod, and, of course, care should be exercised to avoid overheating. In using this welding method to join heavy silicon-copper plates, the edges should be beveled, as previously described, and it is good practice to use a back-up bar. A slightly reducing flame is recommended, and the best results are generally obtained by working upward, with the work inclined approximately 30 degrees. The strength of the weld can be increased considerably if it is peened on both sides after each bead, but excessive peening should be avoided.

The information and photographs presented in this article were supplied by the Bridgeport Brass Co., Bridgeport, Conn.

Waterbury Farrel Foundry & Machine Co. Celebrates Hundredth Anniversary

THE year 1951 marks the centennial anniversary of the Waterbury Farrel Foundry & Machine Co., Waterbury, Conn., manufacturer of metal-working machinery. The company was founded on March 5, 1851, by Almon Farrel, who purchased the Waterbury Iron Foundry Co. and reincorporated it under the name Farrel Foundry. As the business developed, a machine shop was added for finishing some of the company's castings and manufacturing machine parts and accessories. Gradually, the foundry portion of the business became subordinated to that of machine building, which is the concern's present function.

During the past century, the company has developed and produced a wide variety of metal-working equipment, and has contributed many important design advances in this field. Also, special-purpose machines have been designed by the engineering department, and this work is continuing as the company moves into its second century.

Waterbury Farrel products today are divided roughly into four main categories as follows: Cold process bolt, nut, screw, and rivet machinery; power presses and other metal products fabricating machines; wire, rod, and tube machinery; and rolling mill machinery and accessory equipment.

To commemorate its centennial, an anniversary booklet entitled "100 Years Ago and Now" has been issued, which gives a detailed history of the organization. Copies of this booklet can be obtained if requested on a company letter-head.

Recent Developments in

New Forging Equipment and the Effects of Large Closed-Die Forging on Various Materials, Described in a Paper Presented at the Annual Meeting of the Society of Automotive Engineers

By E. O. DIXON
Chief Metallurgical and Mechanical Engineer
Ladish Co., Cudahy, Wis.

THOSE concerned with the design of dynamically loaded or highly stressed machine and vehicle parts have long shown a preference for closed-die forgings. Steering parts of wheeled vehicles, moving parts of engines, and power transmitting gears are typical applications of closed-die forgings normally produced in drop-hammers, forging machines, mechanical or hydraulic presses, and in some cases, in special machines of one type or another. This process of metal forming has been favored over others for various reasons, among which may be mentioned the superior engineering properties and uniformity of quality of the forging, and the low cost of producing the final finished shape.

A relatively few years ago, among the heaviest closed-die forgings in quantity production were crankshafts for road vehicle engines. Development of forging tools for heavier parts awaited the appearance of a demand large enough to justify the provision of such facilities. Although a small demand was slowly growing, marked headway in this direction came only with the heavy airplane schedules of the past war.

Crankcases and crankshafts for reciprocating airplane engines, components for landing gear, airframe members, and propeller parts progressively presented needs for larger and better closed-die forgings, resulting in the installation of drop-hammers that increased in rating up to 45,000 pounds by the end of the war. The largest hammers developed for use in this country were 35,000-pound rated drop-hammers of conventional design. In a few cases, these machines were originally built with potential power capacities above normal, which permitted conversion later to a 45,000-pound rating. (Rating of steam drop-hammers, in common practice, refers to the weight of the reciprocating parts of the hammer.)

This stage in the development of larger capacity hammers appears to approach closely the maximum size possible in the conventional design. Standard practice in the design of these hammers was to provide an anvil block having a weight of eighteen to twenty times the rating of the hammer, which required anvils of approximately 800,000 pounds. Such anvils had to be made in three or more parts because sufficiently large single pieces were not available due to limitations of foundry capacity, machine tool capacity, and transportation.

As larger sizes of hammers are contemplated, a point is arrived at where a deficiency appears in the strength of the top anvil sections when the maximum weight obtainable is spread out over the larger horizontal dimensions required. Maximum obtainable anvil weights, however, are rising. Forged anvil sections of 500,000 pounds are said to be practicable. Sectional anvil designs involving the use of wrought-steel plates 15 inches or more in thickness, and disposed vertically, had been tried with smaller hammers, but the performance did not look promising for the increased sizes of machines. It appeared to observers that the loss of forging effect through the foundations to the earth increased in proportion to the size of hammers. Furthermore, the amplitude of earth shock, as well as the range at which it was felt, increased substantially, adversely affecting precision machining operations nearby.

In the meantime, work was done with closed dies in hydraulic presses of considerable capacity. Experience has shown that the light metals, in particular, lend themselves well to working under conditions where the die travel is slow, but where pressure can be maintained for much longer periods than is possible with an impact which necessarily has extremely short duration. This is probably due to smaller temperature differences between the dies and the forging billets than occur with steel, as well as marked differences in the flow characteristics of the metals involved.

Complex forgings in the light metals, of sizes and shapes that have not been practicable up to

Large Closed-Die Forging

the present time in the prevailing type of impact hammers, have been produced satisfactorily by means of closed dies in hydraulic presses. This technique, however, has not resulted in complete success with steel and high heat-resistant alloys when sharp corners or certain other normal forging difficulties arise. In practice, 5000-ton presses failed to produce accurate, filled, closed-die forgings, such as had been produced in 12,000-pound drop-hammers. What greater press capacity would have served in this case was not determined.

Calculations confirmed by experience indicate that the peak pressures reached during impact in closed-die forging hammers of 45,000-pound rating are substantially higher than any obtainable under hydraulic presses. The rate of energy dispersion during the blow of a 45,000-pound hammer of conventional style has been shown to exceed several million horsepower. It is the tremendous pressures thus developed that act, at least in the case of steel, to fill sharper radii and more difficult outlines under impact than can be done under the low pressures of hydraulic presses, even though the latter can be maintained for much longer periods of duration. On the other hand, there are probably many forging operations in steel, of relative simplicity, where the use of presses will prove distinctly advantageous.

Immediately upon cessation of hostilities on VE day, prompt reconnaissance throughout the principal interior German industrial areas by an American forging authority disclosed that certain large capacity presses and hammers had been used effectively for closed-die forging of sizes not approached in this country. One such press was rated at 30,000 metric tons (about 29,500 long tons). It was discovered also that the Germans had developed progressively, from previously built smaller sizes, a huge drop-forging hammer of a type that avoided in its construction and operations some of the most objectionable features of the larger hammers of the prevailing American design, and that this hammer had substantially greater capacity with respect to energy of blow, and consequently size of forgings that could be produced.

In this hammer, the large inertia mass required in the form of an anvil block was avoided by mounting the lower die in a movable ram which reciprocated counter to the upper ram and die. The two rams met at the center of their combined travel with a complete conservation of momentum, in contrast to transmitting the force of the blow through the forging to the stationary anvil block and foundation.

Through the employment of this principle, the Germans produced a counter-blow hammer equivalent in forging performance to a conventional hammer of 100,000 pounds estimated rating. A schematic diagram of this machine is shown in Fig. 1. The component parts include the baseplate, which weighs approximately 100

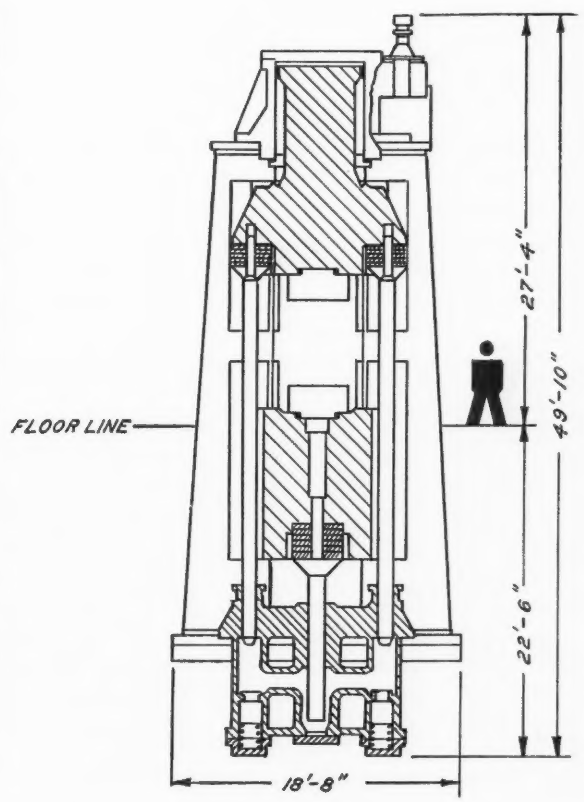


Fig. 1. Schematic diagram of a counter-blow drop-forging hammer equivalent in forging performance to a conventional hammer having an estimated rating of 100,000 pounds

tons; four vertical columns, which guide the rams at their four corners, each 32 feet long and weighing 55 tons; a steam cylinder with a bore of 67 inches; upper and lower rams, weighing 104 and 110 tons, respectively; and a hydraulic coupling, which synchronizes the counter motion of the upper and lower rams.

The latter mechanism comprises two plungers, one attached to each side of the upper ram, which are driven downward into oil cylinders at the base of the machine, the oil displaced forcing the lower ram upward by means of a suitable piston and cylinder. Spring-loaded shock valves relieve excessive pressures. Sandwich buffers of steel and rubber reduce inertia loads between the top ram and side plungers, and two stands of buffers cushion the bottom ram on its return stroke.

The upper ram and the main piston are integral. Primary power comes from the double-acting cylinder into which this piston operates. Hammer operation is through a main balanced piston-valve which is actuated by a "servo" piston, the latter, in turn, responding to the motion of a lever-controlled valve handled by the hammer operator. An air-valve control at the operator's station actuates an air cylinder to clamp the cut-off valve in a fixed position, so restricted as to permit inching of the rams for die setting or other reasons. The hammer described was brought to this country after the war by USAF and allocated to Ladish Co. at Cudahy, Wis., where it was reassembled and has been operating approximately one year.

The forging capacity of this hammer may be visualized from the statement that it has been used to produce totally enclosed die contour forgings weighing over 8000 pounds each. The pressures developed at impact in a hammer of this character are of sufficiently great intensity to produce a forging effect which would, in the writer's opinion, be far beyond the capacity of any existing press.

It will be of interest to outline briefly a few of the problems encountered in providing the necessary auxiliaries for a closed-die operation of this type. For instance, a special die-sinking machine had to be made to reproduce the impressions in the dies. Because of inadequate crane capacity at the location needed, it was necessary to locate the machine outside of the regular die shop, in a heavy maintenance shop. Special wagons were required to move the die-blocks to and from the hammer.

Heating furnaces of conventional design were inadequate from the standpoint of scale control, as well as temperature control, for certain jobs. Specially designed and built furnaces had to be provided, with more accurate and constant fuel-air ratio control mechanism and automatic program temperature control to maintain proper time-temperature cycles for the large billets involved. As center areas of such large sections are quite tender and of low ductility, rapid heat application to the outside of the forging billets may cause internal ruptures. Thermal gradients within the billet must, therefore, be maintained below a dangerous level.

Heating periods become substantially longer as masses increase; but, by the previously mentioned fuel-air ratio control, proper uniformity of temperature through the large heating space, and effective exclusion of outside air, the heating of 20-inch sections weighing over 9000 pounds is accomplished with a final scale thickness of only 1/32 inch.

Die-blocks naturally must be substantially larger for such a hammer. So far, blocks 24 by 48 by 154 inches, weighing approximately 50,000

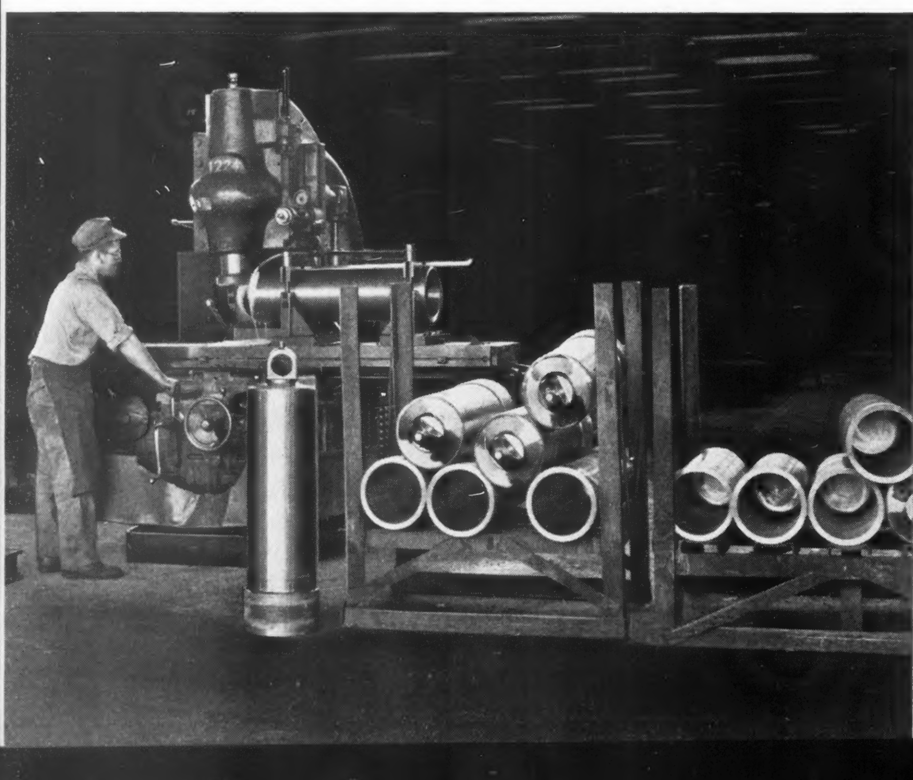


Fig. 2. Aircraft landing gear cylinders extruded from hinged end sections provide great savings in metal and machining operations

Table 1. Physical Properties of Steel Forgings Made in Open and Closed Dies

Section Tested	Yield Strength, Pounds per Square Inch	Ultimate Tensile Strength, Pounds per Square Inch	Ratio of Yield Strength to Ultimate Tensile Strength	Elongation in 2 Inches, Per Cent	Percentage of Reduction in Area
OPEN-DIE FORGINGS					
Longitudinal at Surface..............	111,500	147,625	0.757	16.8	55.6
Longitudinal at Center...............	102,500	141,500	0.726	13.0	28.6
Transverse..........................	107,500	138,000	0.779	5.5	9.2
Average Values	107,166	142,375	0.754	11.7	33.1
CLOSED-DIE FORGINGS					
Longitudinal at Surface..............	113,000	147,500	0.769	17.4	56.8
Longitudinal at Center...............	122,500	141,000	0.865	15.0	49.8
Transverse..........................	120,000	138,375	0.866	7.5	14.2
Average Values	118,500	142,295	0.825	13.3	40.3

Note: Size of section tested 4 7/8 inches diameter. Identical billets produced of material from same bars with identical heat-treatment. Tensile test made on 0.505-inch diameter round specimen.

pounds, have been employed. While blocks made up to the present time have been satisfactory, experience has not been sufficiently broad to state that there is no problem of die-block quality in these sizes.

Forging billets handled have weighed up to 12,000 pounds, and have been beyond the capacity of the usual billet-handling equipment in heavy drop-hammer shops. To serve the counter-blow hammer described, it was necessary to provide a specially designed floor type manipulator. This manipulator charges furnaces, serves billets to the hammer, and transfers forgings from hammer to trim press and from trim press to plant buggy. Its capacity is 12,000 pounds at an outboard distance of 10 feet.

Steam requirements for the operation of such a large hammer naturally called for a substantial boost in boiler capacity. With a 67-inch diameter cylinder and a stroke of over 40 inches, it was also deemed wise to provide ample nearby storage of steam to aid in maintaining adequate supply pressure. In order to accomplish this steam accumulation, added capacity was provided in the form of an over-size steam main, 14 inches in diameter by about 200 feet long.

Many of the forgings produced in this large hammer are of such types of steel as to require accurately controlled cooling after forging to avoid internal defects. Because of the size of the forgings, previously provided furnaces frequently were insufficient to accommodate them and larger controllable cooling facilities had to be provided.

In addition to this development in impact hammers, other innovations in closed-die forging have occurred over the past decade. The extrusion of projections from larger bodies of metal formed in closed dies has been successfully carried out on a large scale. Fig. 2 shows the machining of airplane landing gear cylinders extruded from hinged end sections. Complex multiple-cylinder forging presses have been devised to produce, among other things, plane propeller hubs having pierced barrels for the blade sockets. A third development is the production of weldless rolled rings of complex contour. The range of application of such designs extends over many fields, including ring gears up to several feet in diameter, cable sheave rims, and pipe and heat exchanger flanges.

The expanding engineering and manufacturing activity with which we are now faced presents an opportunity for increased economies through the adoption of these new developments in hot metal-forming. It should be realized that, in many cases, the quality of metal thus provided is definitely in contrast with that in forgings produced by other methods. It has been shown, particularly in the case of impact forgings made in closed dies, that higher values may be expected for transverse ductility measurements, such as elongation and reduction of area in static tensile tests. Table 1 gives representative values to illustrate this point. In many cases, ductility in transverse sections has proved to be the outstanding measure of suitability of a material for best performance in the finished part.

Table 2. Density Values of Cast and Wrought Steel Ingots after Plastic Working by Various Methods

Values given in grams per cubic centimeter at 20 degrees C. (plus or minus 0.01 degree C.)

	As Cast	Rolled to 11 Inches Square	Reduced 83 Per Cent to 11 Inches Square in a Flat Die	Forged from Ingot in a Closed Die	Forged from Piece 11 Inches Square in a Closed Die
Samples in Group 1	7.82789 7.82787 7.82778	7.82967 7.82992 7.82976	7.82984 7.82971 7.82966	7.83004 7.82995 7.83013	7.83032 7.83012 7.83035
Samples in Group 2	7.82812 7.82809 7.82772	7.82983 7.82981 7.82997	7.83058 7.83015 7.83004	7.83010 7.83049 7.83016	7.83006 7.83005 7.82991
Spread*	0.00040	0.00030	0.00092	0.00054	0.00044
Average Density	7.82791	7.82983	7.83000	7.83015	7.83014

*Difference between samples of highest and lowest densities.

Another measurable difference between metal impact-forged in closed dies and the same material forged to the same shape by other means is the density or specific gravity. Precision determinations of this characteristic have shown quite consistent increases in the density of rolled or cast metal following impact forging. Table 2 gives characteristic values not previously reported for the density of steel as cast in exceptionally sound ingots after plastic working by various methods. In the first column, the density of the cast material is shown to be 7.82791, which is the average of six determinations on two sets of samples. When the ingot is rolled to 11 inches square the resulting density is 7.82983.

When ingot material is forged under flat dies to obtain a reduction of 83 per cent in cross-section, the average density is 7.83000. When the ingot material is forged in closed dies by impact only, without plastic flow, the average density is 7.83015. When ingot material rolled to an 11-inch round-cornered square section is forged in closed dies without appreciable plastic flow, the average density is found to be 7.83014.

The significance of these relatively slight variations in density may perhaps be better appreciated if the deviation from perfect soundness is considered, rather than the much smaller proportionate difference in the absolute density. An option to increase the imperfection and unsoundness in the material comprising the most important dynamically loaded members of mechanisms designed for minimum weight would not be highly valued by most engineers. Rather are designers more likely to insist that the effort be made to move in the opposite direction, namely, toward a closer approach to perfect soundness.

Progress in this direction, particularly to improve the minimum properties obtained under impact-forging techniques, will permit designers and manufacturers to increase safe working loads and increase ratings of performance. The result to be expected is that forged metal parts produced in closed dies yield better and more dependable service. Through increase in the size of individual forgings, lighter designs are possible; less machining is required; machined fits, connections, and weld preparations are eliminated; and the machining equipment, labor, processing time, and bulk of material inventory in factories, which these factors inevitably invoke, are obviated.

With the trend toward larger individual forged parts gaining impetus, it is safe to predict that certain developments will gain headway, with highly advantageous results—for instance, bigger machines, such as hammers and presses. Discussions with aircraft designers already indicate a need for larger forgings than present hammers can produce.

Also, better heating methods must be developed. Heating is a very important factor in the quality of forgings produced under hot plastic flow. In all cases, the efficiency of the operation is affected. The internal properties of the forgings in most instances are affected to a greater or lesser degree by the time-temperature cycles to which the material is subjected preceding forging. Often surface quality and metal quality are modified favorably or otherwise by temperature levels and the uniformity and accuracy with which they are maintained.

Time-temperature cycles in the case of heavy sections become of greater importance as cross-sectional dimensions increase. The exposure to chemical reaction between metal and furnace atmosphere, of course, increases as the section to be heated becomes larger. Consequently, the problem is substantially aggravated as the size of forgings being made is increased.

Several avenues of approach to this problem are open. One, which is adequate in many cases but does not produce the quality required in others, is the improvement of standard combustion furnaces to a degree where fuel-air ratios are maintained at optimum values continuously; where hot gas flow within the heating chamber

is controlled by location of burner ports and flues to produce uniform distribution of temperature and chemical activity between atmosphere and metal; and where irregularities in furnace conditions due to leakage of air through door operation are reduced to a minimum.

By proper control of these factors it has been possible to heat 18-inch steel through a twelve-hour period to a temperature of 220 degrees F., with scale thickness of only 0.035 inch, which is equivalent to a metal waste of 0.014 inch. In many instances, this represents a thoroughly acceptable improvement over current practice.

At the other end of the scale in complexity of heating equipment, perhaps, is the full muffled furnace, combustion heated, with inert atmosphere maintained with a muffle. This type of heating has proved extremely satisfactory for small sections of, perhaps, not over 2 or 3 inches.

However, the method is expensive because of the cost of maintaining the inert atmosphere; the relatively frequent failure of muffles; and the high temperature, maintenance, and fuel cost required for the heating chamber proper and the outer heating chamber, which must be held at temperatures several hundred degrees above the work temperature required for the metal. Also, tonnage heated per square foot of floor space is but a small fraction of that obtained when heating by conventional combustion furnaces. Nevertheless, in certain special applications, such as where very thin sections are to be heated and the scale in the final product must be held to an absolute minimum, this method has been used with success.

The growing use of high-frequency electrical induction heating for forging is an indication of the economic soundness of this method in selected applications. In many cases, the actual formation of scale is negligible; in others, the type and amount of scale formed is of such character that it has little detrimental effect. Induction heating for forging has many important advantages, among which are the following: No energy loss for starting and stopping; greatly improved working conditions; reduced floor space; substantial improvement in cleanliness of shop; and improved efficiency in spotting hot metal at convenient delivery locations. Perhaps the greatest disadvantage of induction heating is the high cost of electrical apparatus required.

A final method of improved heating is the use of molten salt baths, which has gained favor for certain special operations, particularly where spattering from impact dies is not a disadvantage. Although molten salt heating has been used in isolated instances for many years, progress in its adoption has recently been accelerated through the development of more fluid salts yielding less drag-out loss and less waste salt to interfere with die operations.

Controls have also been developed to prevent undue decarburization. Improvements in the application of energy to maintain temperature have been devised, resulting in better temperature control, better peak load characteristics, and generally more satisfactory operation.

Molten salt heating is of advantage where surface finish must be preserved, where reduction of friction between dies may be of importance in promoting greater ease of filling in impressions, and where there is no tendency to spatter molten salt by the impact of dies.

Another requirement to meet the needs of larger parts is to provide bigger and better die-blocks than have been available up to now. As was mentioned previously, a few large blocks have been produced which were entirely satisfactory. There is, however, a distinct problem in providing complete soundness in the largest sections required. Die-block producers have stated that the sizes given here approach closely the maximum they are prepared to produce with existing facilities. Hydraulic presses are now available in other shops which are capable of handling die-block ingots as large as can be foreseen at this time as being necessary.

Still another avenue of improvement lies in the field of lubrication. The performance of all tools and their success in producing closed-die forgings can always be improved by better lubrication of the metal die interface.

In forging steel, decarburization and carbon restoration are two processes which must be given serious consideration in the future if best results are to be obtained. While the remarks made in the foregoing have applied primarily to steel, it must be kept in mind that other forgeable metals include aluminum and magnesium, with their alloys; nickel-base alloys; copper-base alloys; titanium; and the refractory heat-resisting alloys now coming into application for gas turbines.

As the sections in which these metals are required for forging increase in size, greater difficulty will be encountered in obtaining soundness throughout such sections. In steel, this problem was encountered a number of years ago, and the present situation reflects the results of good work carried out by a number of the steel producers engaged in supplying aircraft grades of steel. With many of the other materials mentioned, the demand for heavy sections did not appear so early, and as a result, we are confronted today with the need for development along similar lines.

Tool Engineers to Hold Annual Meeting in New York

THE theme of the nineteenth annual meeting of the American Society of Tool Engineers, which will be held in New York City at the Hotel New Yorker March 14, 15, 16, and 17, will be the mobilization of production know-how. A pre-meeting conference between industry and top military officials will be held Wednesday evening, March 14. The military will be represented at this conference by Lieutenant General Kenneth B. Wolfe, deputy chief of staff for materiel, Department of the Air Force; Colonel John S. Walker, district chief, New York Ordnance District, U. S. Army; and Captain C. L. Helber, supervising inspector of naval material for New York, who will represent the U. S. Navy. Prominent American industrialists, besides those who are members of the A.S.T.E., have been asked to attend and participate in the conference.

The meeting will be in the form of an open forum to help develop the best ways for industry and the armed forces to work together in correlating available production techniques with military requirements. The tool engineers will ask questions of the officers and vice versa. An important point to be discussed will be the critical question of tolerances—how much leeway can be developed to expedite production and still meet military specifications in various cases. Roger F. Waindle, general manager, Industrial Products Division, Elgin National Watch Co., and a vice-president and national director of the A.S.T.E., will preside.

The technical sessions will open the meeting proper on Thursday, March 15. These have been planned to give as much up-to-date information as is possible within three days to the men responsible for planning the nation's defense on the industrial front. A total of thirty-four papers will be presented—more than have ever before been presented at an A.S.T.E. meeting.

In order that each visiting tool engineer can attend all sessions of particular value to him, the sessions have been scheduled in such a way that no two on the same general aspect of production will occur at the same time. A tool engineer who is chiefly interested in press work, for example, can attend five sessions relating to this subject during the meeting, ranging from suggestions on how to get optimum use from mechanical presses to the economics of machine replacement.

A great deal of material on machining, tooling, quality control, machine design, etc., will also be presented. Another important item on the agenda is a schedule of tours through nine nearby manufacturing plants selected for their efficient methods. Visitors will take home from these plants ideas that may be of great value to defense production when applied in their own factories.

R. F. V. Stanton, executive vice-president and general manager of the American Machine & Foundry Co., and former chief of the Army Ordnance Small Arms Division at Hartford, Conn., will be the featured speaker at the banquet session on Friday evening, March 16. He will speak on "Tool Engineering—America's Strength" and will discuss the tasks faced by tool engineers to protect the American economy.

During the four-day meeting, national directors of the Society will elect a new panel of officers; these will be announced at the banquet session. Other Society activities on the agenda include a dinner for past A.S.T.E. presidents.

Host to the visiting tool engineers will be the Greater New York Chapter, assisted by the Northern New Jersey, Mid-Hudson (Poughkeepsie), and Philadelphia Chapters. The general chairman of the meeting will be Harmon S. Hunt, chief tool engineer of the Bulova Watch Co.

Execution of the program details set up by the National Program Committee is in the hands of men from these chapters. Those in charge of technical activities and technical sessions are Holbrook L. Horton, associate editor, MACHINERY; James FitzPatrick, of Straubenmuller Textile High School; and Horace E. Linsley, associate editor of the *American Machinist.*

The plant tours have been arranged by Joseph P. Schneider, service engineer of National Twist Drill Co., and Hugo L. Aglietti, secretary-treasurer of Taag Designs, Inc. The banquet session is in charge of a committee headed by Carl Kertesz, vice-president of Design Tool Corporation and chairman of the Greater New York Chapter of the Society.

* * *

It is reported that at the turn of the century there were 3300 pounds of steel in use for every man, woman, and child in America. Now there are 14,500 pounds.

Arc-Welding Stainless Steel without Columbium

Corrosion Resistance is Obtained without Columbium by Welding Extra Low Carbon Steels with Extra Low Carbon Electrodes

By RICHARD K. LEE
Vice-President in Charge of Research
Alloy Rods Co., York, Pa.

WHEN weldments of stainless steel (chromium-nickel) cannot be annealed after welding, or when the weldment is to be used in the temperature range of approximately 800 to 1500 degrees F., it is customary to add columbium for the purpose of preventing intergranular corrosion in the "heat affected zone." In this article, an attempt will be made to describe the phenomenon of intergranular corrosion in simple terms. The arc-welding industry can best be served by a broader understanding of this problem which, to a large degree, has been known only to the metallurgist.

The success of arc welding is dependent upon having sufficient heat to completely fuse both plate and weld metal into one integral part. The weld metal reaches a temperature above its melting point in the neighborhood of 2900 to 3000 degrees F. The plate metal near the weld is, of course, at a very high temperature during the welding operation because it is in contact with the molten metal, and therefore reaches a temperature just below melting—around 2600 to 2700 degrees F.

As compared with ordinary carbon steel, chromium-nickel stainless steel has very poor thermal conductivity, or ability to carry away and dissipate the heat of the weld metal. Therefore, a sharp temperature difference exists, so that most of the heat is confined to a narrow band or zone which is between 800 and 1500 degrees F. a short distance from the weld metal for a relatively long period of time. This zone is commonly known as the "heat affected zone." The welder has proof that this zone exists because, immediately after completing a stainless-steel weld, he can place his finger within 1 inch of the weld, whereas this would be impossible to do on ordinary carbon steel without experiencing considerable discomfort.

When austenitic stainless steels (chromium-nickel) are heated to a temperature range of 800 to 1500 degrees F. and held at that heat for any appreciable period of time, such as occurs in the heat-affected zone just referred to, chromium carbides precipitate at the grain boundaries. The formation of chromium carbide results in a depletion of chromium at the grain boundaries, with resultant failure of the plate when used in corrosive service.

The addition of columbium or titanium will inhibit or prevent the formation of chromium carbide because both of these alloys have greater affinity for carbon than chromium has. Thus, the formation of either columbium carbide or titanium carbide allows the chromium to go about its business of resisting corrosion.

However, the use of columbium for this purpose has been limited due to the fact that the United States Government has recently placed columbium on the critical list of strategic materials, and ordered that its use be confined to aircraft and other important defense projects. As titanium has characteristics similar to columbium, it could be substituted for the latter alloy in the plate metal for most weldments. But, unfortunately, it cannot be substituted in the welding electrode, because it is easily oxidized and very small quantities are recovered in the weld metal after transferring across the arc.

The obvious answer to the problem of carbide precipitation and resultant poor corrosion resistance is to remove the carbon. It has long been known that up to 0.02 per cent carbon will remain in solution in austenite at temperatures of 800 to 1500 degrees F. For example, in a stainless steel containing 0.07 per cent carbon, only 0.05 per cent will precipitate as chromium carbide, the balance (approximately 0.02 per cent) remaining in solid solution. But steels having a carbon content of 0.02 per cent maximum are not practical to produce. Investigations have shown that only a slightly greater carbon content —0.03 per cent maximum—is, for all practical

purposes, low enough to prevent appreciable carbide precipitation after a short exposure to temperatures of 800 to 1500 degrees F.

Since 1945, the extra low carbon grades of stainless steel have been under test and development by several steel mills. Many weldments of these steels have been in successful operation since 1948 in a wide variety of industrial applications. The same resistance to corrosion is obtained when 304 ELC plate (extra low carbon) is welded with 308 ELC electrodes as when columbium is used in both the plate and electrode. Extra low carbon electrodes can be used successfully to weld Type 347 plate (columbium stabilized) or Type 321 plate (titanium stabilized). No zones of corrosive attack occur in either of these two weldments, and the same resistance to corrosion is obtained when Type 347 electrodes are used to weld Type 347 plate. Type 316 ELC electrodes are also available for welding Type 316 ELC plate (columbium stabilized), and Type 318 plate.

Selling to the Department of Defense—The Army, Navy, and Air Force

MANY manufacturers, faced with material shortages and curtailment of civilian goods, are seeking defense orders to keep their plants operating. Such orders do not come without effort on the part of the manufacturer. However, a manufacturer may waste time seeking war orders through trips to Washington. Information, and eventually orders, can often be obtained more quickly by writing.

The Department of Defense, under which fall the Army, Navy, and Air Force, has assigned to individual military departments the responsibility of procuring certain supplies and services for all three units, and these divisions have offices that buy for their individual needs.

The divisions maintain "bidder lists." Manufacturers should be on these lists to receive a chance to bid on a formally advertised contract or to be approached for a negotiated contract. Wherever possible, the advertised method is used; however, negotiated contracts are permitted under the recently declared national emergency.

The Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C., has available three booklets that list the purchasing offices of the Army, Navy, and Air Force, and give a brief descriptive list of the items each purchases. The method of getting on "bidder lists" and the necessary steps in seeking contracts are also explained.

These booklets are: (1) "How to Sell the U. S. Army" (30 cents); (2) "Purchasing Items and Purchasing Locations of the Department of the Navy" (20 cents); and (3) "A Guide for Selling to the U. S. Air Force" (15 cents).

Another service is available to manufacturers who want information on the purchasing office to write to for a specific product. Letters listing products a manufacturer can make should be addressed to the Military Procurement Information Office, Munitions Board, The Pentagon, Washington 25, D. C.

As an aid to businessmen in obtaining current information on what the Government is purchasing, the United States Department of Commerce publishes daily a "Consolidated Synopsis of U. S. Government Procurement Information." It lists the purchasing office making the procurement, the item contemplated and the quantity, the invitation for a bid, and the bid opening date. A firm may bid on any item listed by writing to the office doing the buying, giving the IFB number, and requesting a bidding set.

There are many concerns who can handle only sub-contract work. To facilitate small businesses in obtaining the names of the firms awarded unclassified Department of Defense contracts in amounts over $25,000, the Department of Commerce publishes weekly the "Consolidated Synopsis of Contract Award Information." This gives the name and address of the successful bidder, the commodity purchased, the quantity, and the value.

Both contract award and procurement information synopses may be reviewed at local Chambers of Commerce and field offices of the U. S. Department of Commerce. They can be received regularly if a request is made to the U. S. Department of Commerce, Division of Printing Services, Washington 25, D. C.

* * *

Out of industry's average profit of 5 cents on each dollar of sales, 2 cents is paid out to stockholders in dividends and 3 cents is plowed back into the business.

TOOL ENGINEERING *Ideas*

Tools and Fixtures of Unusual Design, and Time- and Labor-Saving Methods that Have been Found Useful by Men Engaged in Tool Design and Shop Work

Spindle for Grinding Punches Having Various Sized Threads

By L. KASPER, Philadelphia, Pa.

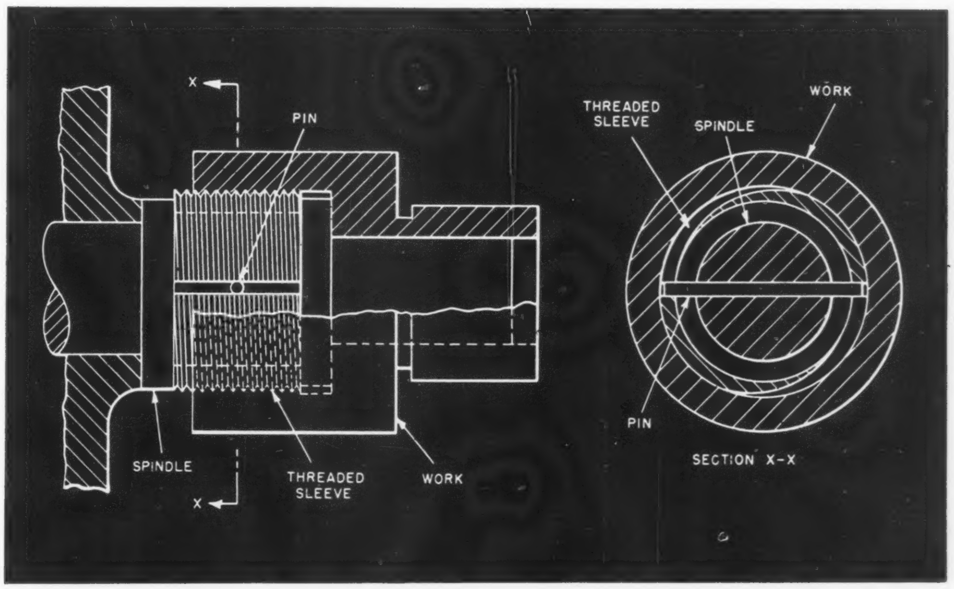
In grinding a large number of internally threaded punches for a compound die, one of the specifications was to maintain a close tolerance on the concentricity between the inside and outside diameters at their working ends. The inside diameters at the working ends were to be identical, but their outside diameters varied. Also, the internal threads in the punches were to vary in both diameter and pitch.

The quantity required of each size punch and the close concentricity necessary warranted the construction of a special grinding spindle that would locate the pieces on their previously ground bores and would lock the piece so that it would be rotated by means of the thread. The combination of thread variations to be carried on the same spindle presented a problem, but this was overcome in a simple manner, as shown in the illustration.

A hardened spindle was fitted into the bearings of the grinding machine and ground in position. The outer end of the spindle acts as a pilot for locating the punch to be ground, thus insuring perfect concentricity with the axis of rotation. Close to its bearing surfaces, the spindle is enlarged and recessed to form two flanges. An externally threaded sleeve is cut lengthwise through its center to form two sections with a space between.

The length and inside diameter of this split sleeve are such that it will fit between the flanges of the spindle, and the outside diameter and thread pitch are made to fit the punch. A pin passes through the spindle between the flanges, with its ends projecting between the two sections of the sleeve. Since the driving effect is accomplished by the pressure of the outer flange on the spindle against the bottom of the threaded bore in the punch being ground, there is no strain on the pin.

In operation, a sleeve, with its outside diameter and thread pitch matching the part to be ground, is dropped into the recess between the flanges on the spindle. The punch is placed on the pilot end of the spindle and is screwed on the sleeve until it tightens against the outer flange of the spindle. The pin prevents the sleeve from rotating during loading. A series of split sleeves, which accommodates the entire range of punch sizes, renders the change-over practically instantaneous. Since the locating part is not disturbed, there is no change in accuracy when grinding different punches.



Special spindle equipped with a series of split, externally threaded sleeves for grinding punches having internal threads of various diameters and pitches

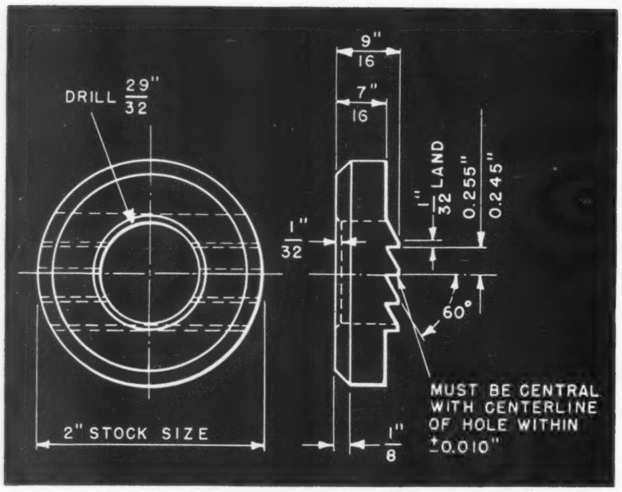


Fig. 1. Serrated washer for a cylindrical grinding machine, which is accurately and securely held during milling by means of the fixture shown in Fig. 2

Milling Fixture with Adjustable Holding Feature

By ROBERT MAWSON, Providence, R. I.

An efficient milling fixture must provide positive location and secure clamping in order to produce accurate, interchangeable work-pieces. However, if the locating and clamping surfaces of the work-pieces vary in size or position, the fixture must be made adjustable to compensate for these variations. Such a part is shown in Fig. 1. This serrated washer, used in Norton cylindrical grinding machines, is made from cold-rolled steel bar stock 2 inches in diameter. Since the periphery of the washer does not require machining, provision must be made in the work-holding fixture to take care of standard variations in the diameter of the part.

The fixture shown in Fig. 2 was designed to hold the part while milling serrations on one face of the washer. Six equally spaced, radial slots, 1/8 inch wide, are machined in the upper half of the fixture base. The counterbored seat provided for the work in the top face of the base is ground to a diameter of 1.999 to 2.000 inches and a depth of 3/8 inch. A tool-steel locating pin, pressed into the upper wall of the fixture base, projects into the slot provided in the bore of the clamping plate.

It will be noted that a slot 1/4 inch wide is provided in one side of this rectangular-shaped clamping plate. Tapped and clearance holes for the cap-screw are machined in the clamping plate from opposite sides of this slot. Two keys, secured in slots provided on the under side of the fixture base, insure proper alignment of the fixture on the milling machine table.

By loosening the cap-screw, the upper part of the fixture base is allowed to expand, thus permitting easy insertion of the part to be milled. The cap-screw is then tightened to contract the slotted portions of the fixture and clamp the washer securely in place. A gang milling cutter set-up, consisting of 60-degree angular cutters mounted between two plain milling cutters on the milling machine arbor, is employed for the serrating operation.

Jig for Drilling Spanner-Wrench Holes

By ROBERT W. NEWTON, Assistant Chief Tool Designer
New York Air Brake Co., Watertown, N. Y.

The lock-nut illustrated in Fig. 1 has two spanner-wrench holes which were originally drilled in a jig designed for drilling three pieces at a time. However, the faces of some of these pieces were not machined square, so that when they were stacked together in the jig, the accumulative error caused the holes to be drilled at such an angle that the pieces were not acceptable. The jig shown in Fig. 2 was therefore designed to

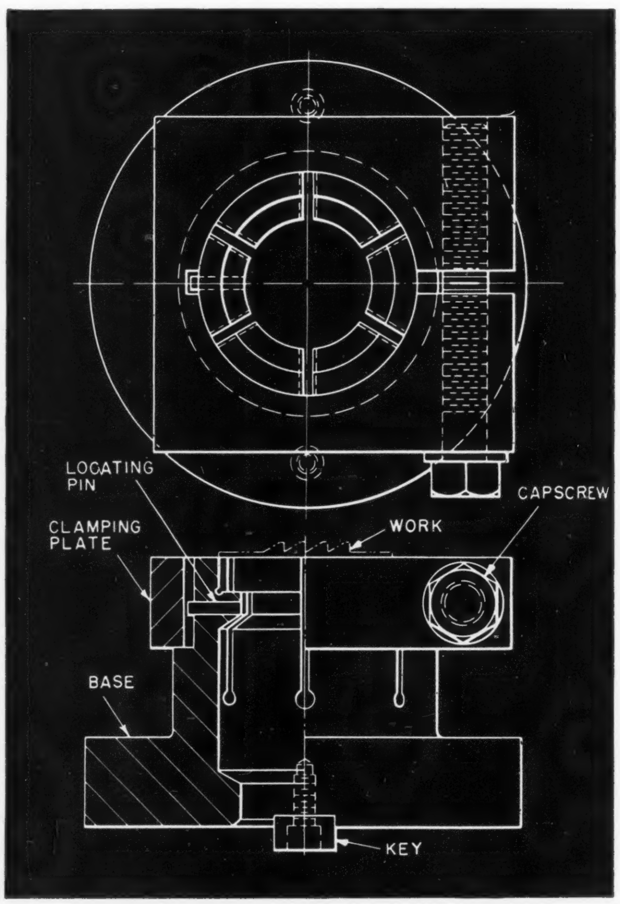


Fig. 2. Milling fixture provided with a slotted base and a clamping plate to take care of variations in the diameter of the washers being machined

drill one piece at a time and still keep the drilling cost at a reasonably low figure.

When cam *A* is moved up in the released position, bushing plate *B* is raised away from sliding block *C* a sufficient amount to allow plenty of room for inserting the work-piece against the two pins *D* which are pressed into block *C*. After these pins have been assembled, they are ground to a slip fit for the work. Loading space is obtained by making the distance from the fulcrum pin *E* to the bushings several times greater than it is to the cam *A*. There is still enough clamping pressure provided to hold the work while drilling with the small drills required for this operation. A spring *F*, held in place by pin *G*, keeps the bushing plate *B* up when cam *A* is in the released position. Bushing plate *B* is a slip fit in the slotted block *H* which is screwed and doweled to sliding block *C*. Fulcrum pin *E* is a drive fit in the slotted block *H*.

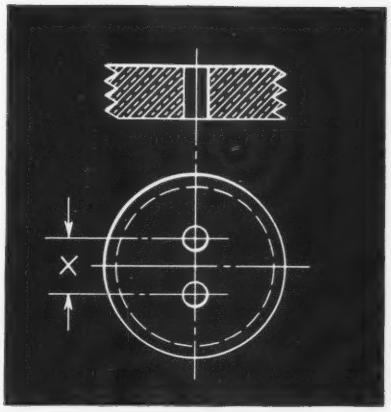
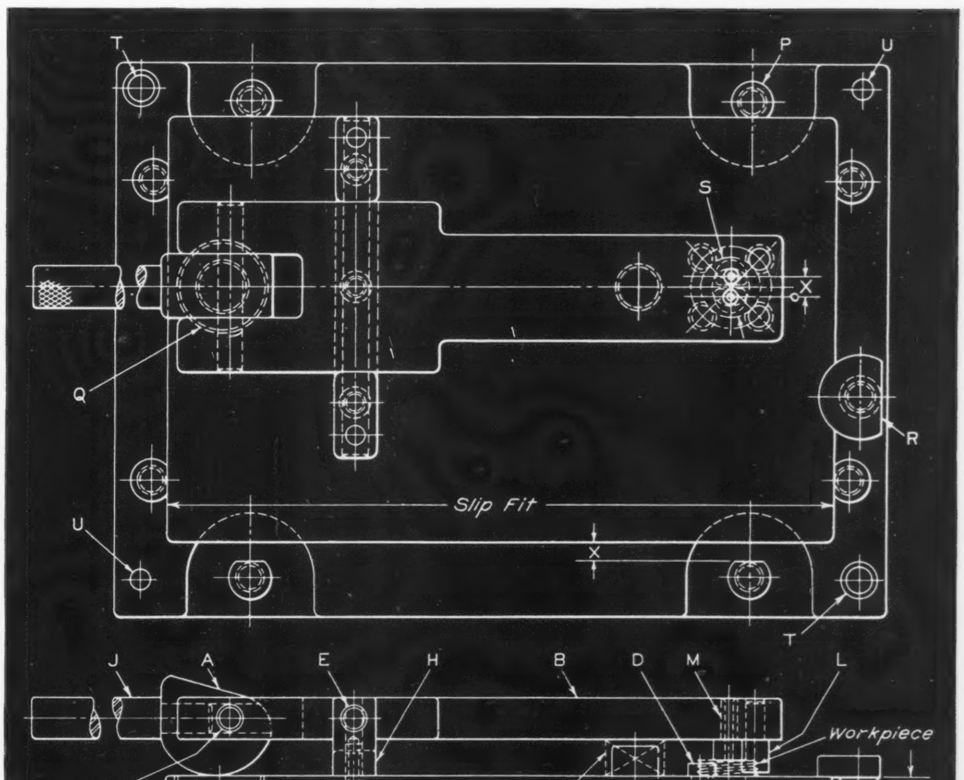


Fig. 1. Special lock-nut in which two spanner-wrench holes must be drilled square with the nut face

After a work-piece has been placed in position against the locating pins *D*, handle *J* is lowered to operate cam *A* in a slot in plate *B* and on pin *K*, which is a drive fit in plate *B*. This lowers the bushing plate to the clamping position, and the jig is ready for drilling. Two other locating pins *L*, which are pressed into plate *B* and are also ground to a slip fit for the work after they have been assembled, slide over the work-piece as the cam lowers the bushing plate to the drilling position. The heads of these two pins must be short enough to clear block *C* when the work is clamped. The heads of the two hardened bushings *M* clamp the work against block *C*.

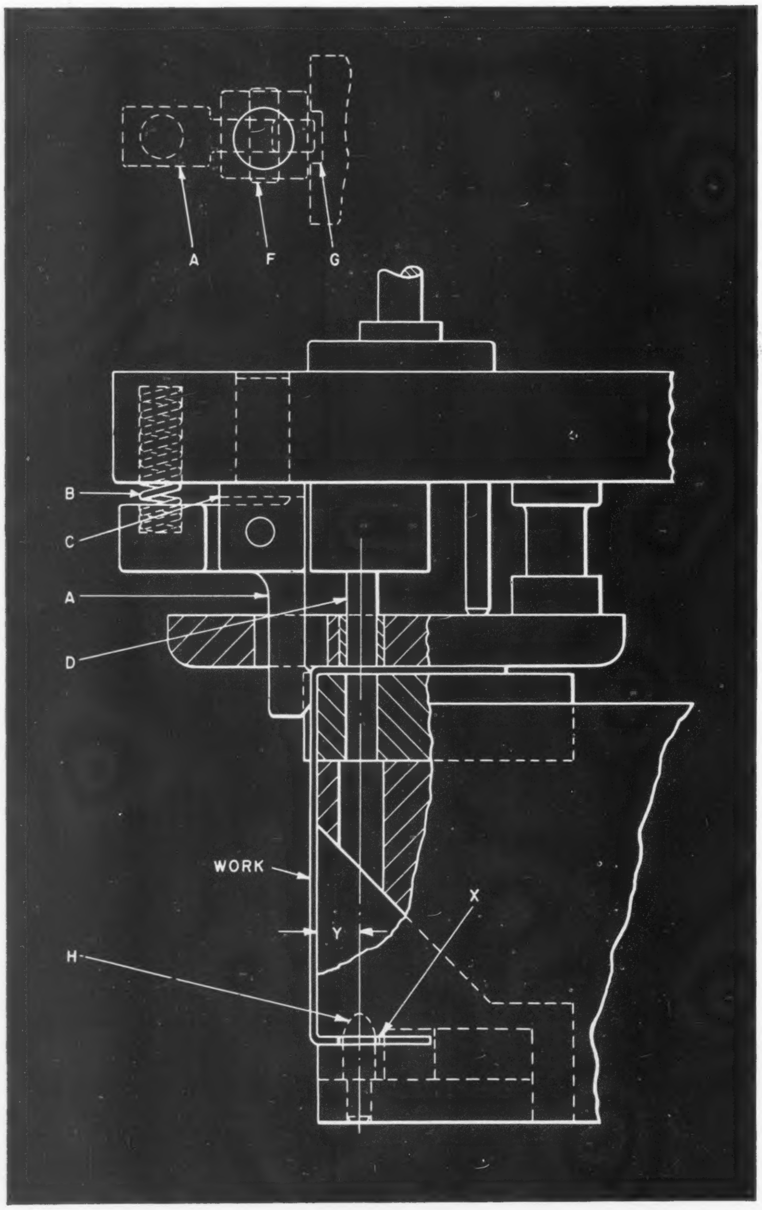
Block *C* slides on plate *N* between four guide pins *O*. Four other pins *P* that are also pressed into plate *N* act as stops for block *C*, but allow movement equal to the center distance *X* between the holes in the work. Plate *N* is fastened to the drill press table by screws *T* and dowels *U*, being so positioned that one of the bushings is under the spindle of the drill press when block *C* is against two of the stop-pins *P*. Four slots are milled in plate *N* to provide chip clearance around the four stop-pins *P*. A hardened button *Q* is pressed into plate *N* to provide a good wearing

Fig. 2. Jig with quick-acting cam clamping arrangement designed for drilling spanner-wrench holes in lock-nut shown in Fig. 1



surface on which the cam can operate. Opposite cam A there is a shoulder screw R which is a slip fit for the thickness of sliding block C. This screw prevents block C from raising off plate N when pressure is applied by the cam. The head of screw R is flatted so that the sliding block can easily be removed for cleaning.

The cam in this jig provides a means of rapidly loading and clamping the work-piece. Since only one piece is placed in the jig at a time, there is no chance of build-up of error due to the faces of the work being machined out of square. By fastening the jig to the drill press table with one bushing in position under the spindle, and providing for movement enough to bring the other bushing under the spindle, fast and accurate drilling results.



Clamp that positions a yoke-shaped work-piece in a piercing die so that the pierced hole will accurately align with another hole in the part

Clamp for Piercing Die Aligns Yoke-Shaped Part

By F. A. ADAMS, Dayton, Ohio

In piercing the yoke-shaped part shown in the accompanying illustration, it was necessary to hold dimension Y—from the inside surface of the part to the center line of the pierced hole—to close limits of accuracy in order to insure that the pierced hole will be in alignment with hole X in the lower leg of the yoke. The work is located for the operation by inserting stud H in hole X and slipping one end of the yoke into a milled slot G in the die-block.

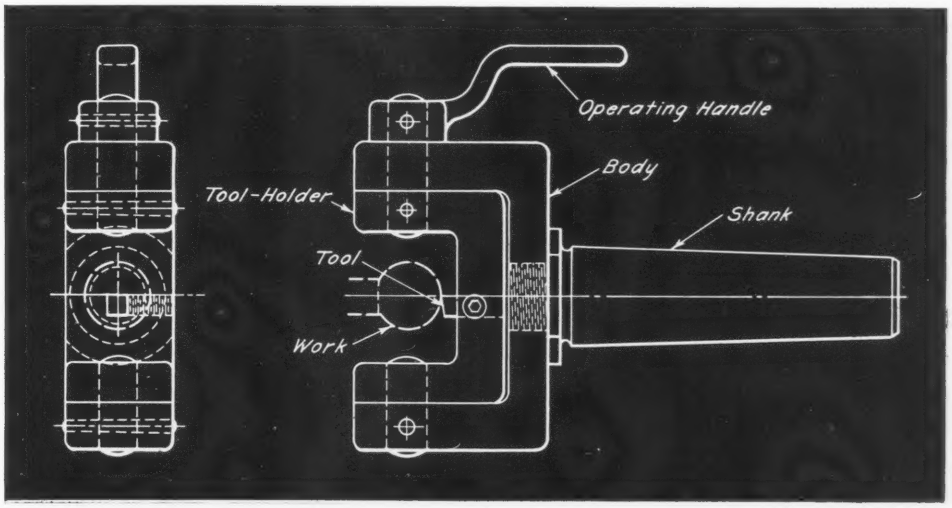
When the ram of the press comes down, clamp A contacts the work and forces it against the die-block. The clamp swivels about a dowel-pin F in block C, and is held tightly against the part by a spring B.

After the piercing operation has been performed, the punch is raised and the clamp releases the work. This leaves the part free, so that the press operator can easily slip it off the stud and out of the milled slot.

* * *

During the last war the Federal Products Corporation produced two motion picture films designed to provide fundamental information on the subject of gaging for educational purposes. These films, "The Dial Indicator" and "Dial Indicator Gages" have been revived, due to the defense program, and are now available to industrial and Army and Navy training schools, colleges and vocational schools, as well as industrial associations or societies. The information contained in these pictures is as applicable today as when they were first produced. The two films are combined on one reel for easy showing, the running time for the entire reel being about forty minutes. A new film is also being prepared covering dimensional air gages, electronic gages, and automatic sorting gages. Those interested in obtaining copies for showing can get further information concerning terms from the Federal Products Corporation, Sales Promotion Department, 1144 Eddy St., Providence 1, R. I.

Ideas for Shop and Drafting-Room



Accurate spherical surfaces can be easily turned on the ends of shafts by means of this simple adapter, which fits into the tailstock of a lathe

Lathe Tailstock Adapter for Turning Spherical Surfaces

By JOHN HOMEWOOD, Ontario, Calif.

Ball ends, or spherical surfaces, can be turned quickly, accurately, and economically with a single-point tool by means of the simple adapter shown above. The hardened and ground shank, which fits into the tailstock of the lathe, is threaded into the cast body of the adapter. A C-shaped tool-holder, mounted on two vertical shafts passing through the body, is pivoted about the work by an operating handle. Both the handle and the tool-holder are pinned to the upper shaft, while the body is pinned to the lower shaft.

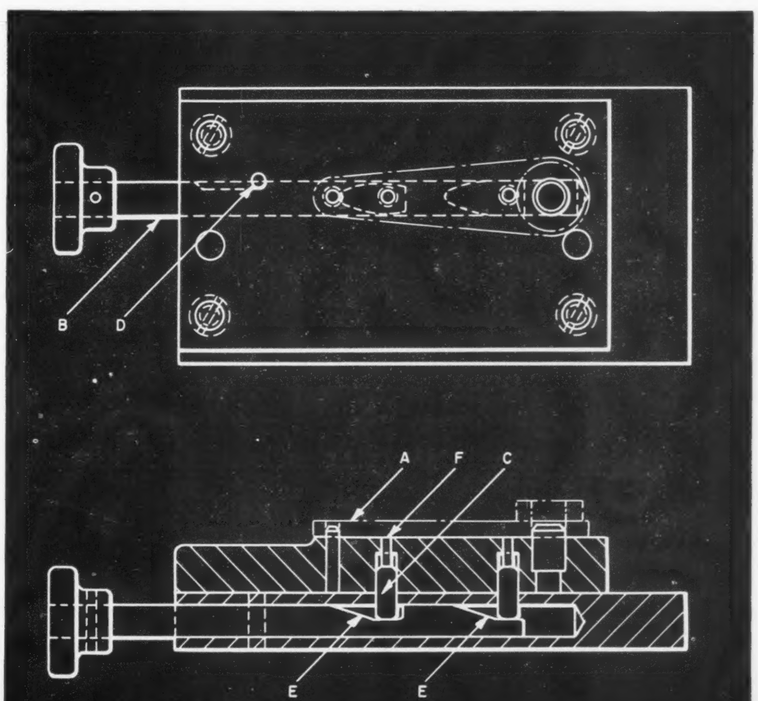
Different sized adapters can be provided to turn various radii, or one adapter can be made adjustable to accommodate several different parts. The operation is facilitated by first turning the stock down to the desired spherical diameter. The turning tool can then be set by swinging the tool-holder to a position at right angles to that shown and using the machined surface as a guide. Both roughing and finishing cuts are generally necessary to obtain an accurate sphere with a smooth surface finish.

Simple Ejector for Fixtures

By F. A. ADAMS, Dayton, Ohio

Sometimes parts have a tendency to stick on locating or positioning studs when the operator attempts to remove them from a fixture. The illustration shows an effective way of eliminating this trouble.

Rod *B* has two angular surfaces *E* milled on it. Contacting these surfaces are pins *C*, which are retained in the fixture by having the upper end *F* turned to a smaller diameter. When rod *B* is moved in, pins *C* are raised as a result of the wedging or cam action of the angular surfaces on the rod. These pins, in turn, lift part *A* from the studs. Rod *B* is prevented from turning by pin *D*, which engages a flat on the shaft.



Simple hand ejector which enables parts to be readily removed from fixtures, gages, and other tools

Questions and Answers

A Department in which the Readers of MACHINERY are Given an Opportunity to Exchange Information on Questions Pertaining to the Machine Industries

Screw Steel that Withstands Hammer Action

A. G. L.—We have been troubled with frequent failures of screws that hold suction valves on ammonia compressor pistons and are held in place by a lock-washer. The compressor operates at a stroke of 3 1/2 inches at 600 R.P.M. up to 10 1/2 inches at 300 R.P.M. Some fatigue is probably involved, due to the hammering action of the valve on its seat, though this effect is cushioned somewhat by a dashpot arrangement. We would like to make the screws from a better steel than the carbon steel now being used. If heat-treatment is required, we would prefer a composition that can be heat-treated in the bar rather than after the threads have been cut. We will be able to machine them readily if the hardness is not over 35 Rockwell C.

Answered by Editor, "Nickel Topics," Published by International Nickel Co., Inc., New York City

Any of the direct-hardening medium-carbon nickel-alloy steels, such as Types 2300, 3100, or 8600 in the 0.30 to 0.40 per cent carbon range, should serve your purpose effectively if oil-quenched and tempered to a hardness of 32 to 36 Rockwell C. The 3135, 3140, and 8640 types are available in bar stock in the size you require from leading alloy steel warehouses.

We note from your drawing that there is no specification for a fillet or radius between the shank and bolt-head. If the parts are actually being made as indicated on the drawing, this may be one source of your trouble, and we suggest that a radius, as generous as possible, be required to avoid trouble from stress concentration at that point.

Validity of Salesman's Guarantee

D. W. T.—When is a seller liable on a guarantee made by a salesman?

Answered by Leo T. Parker, Attorney at Law Cincinnati, Ohio

When the salesman merely "puffs" the quality of his products, or states his own personal opinion, the employer is not liable for the salesman's guarantee. In other words, higher courts clearly hold that there are some statements which, even though asserted positively by either a seller or his agent, cannot be considered as a guarantee, and the seller is not liable.

In Mars vs. Herman [37 Atl. (2d) 351] the testimony showed that a salesman said that the equipment was good grade and "should give you very satisfactory wear." The purchaser sued the seller for breach of warranty on the grounds that the statements of the representative were a guarantee that the equipment would be satisfactory. Although the lower court held in favor of the purchaser, the higher court reversed the verdict, and said: "Plaintiff (purchaser) asked the salesman's opinion, and we regard his reply as an expression of opinion and not an assertion of fact . . . ."

* * *

Conference on Industrial Research

A conference on industrial research will be held at Columbia University in New York City on June 11 to 15. This is the second annual conference of this type. The theme for the present year will be "Personnel and Communications in Research." Further information can be obtained from the director of the conference, David B. Hertz, of Culpepper Hertz, Inc., research consultants, and assistant professor of industrial engineering at Columbia.

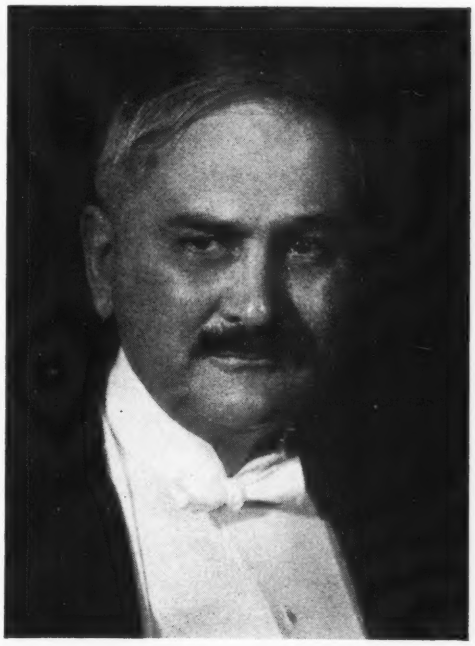
* * *

New Manual on Aluminum Finishes

A manual containing basic information on the various processes for applying surface finishes to aluminum has recently been published by the Reynolds Metals Co. The characteristics of the finishes produced by these processes are also discussed, and a section is included on controls and tests. These books are available without charge to engineers, chemists, production men, and others when requested on a business letter-head addressed to the Reynolds Metals Co., 2500 S. Third St., Louisville, Ky.

Fred E. Rogers, Former Editor of MACHINERY

FRED E. ROGERS, who served on the staff of MACHINERY as associate editor from March, 1899, to 1916, and then as editor until March, 1918, died at his home in East Orange, N. J., on February 8 at the age of eighty-four years. Prior to becoming associated with the Industrial Press, Mr. Rogers had worked as a teacher, farmer, machinist, and writer of technical articles. During his connection with MACHINERY, Mr. Rogers' genial personality and his editorial capabilities won him a host of friends throughout the mechanical industries.



Mr. Rogers left MACHINERY to become president of the Service Engineering Co. in New York City, of which he was one of the founders. The concern was a pioneer in developing special machinery and tools for industrial plants on a consultant basis. Later, he was appointed advertising manager of the Davis-Bournonville Co., and upon acquisition of that concern by the Air Reduction Co., Mr. Rogers entered the publicity department. He originated the Applied Engineering Department's Bulletin, and was its editor for over ten years. In 1940, he retired.

Mr. Rogers was long active in the affairs of the American Welding Society, and was a member of many committees that contributed to the dissemination of welding engineering knowledge. He was also active in the International Acetylene Association, and had long been a member of the American Society of Mechanical Engineers.

Electrical Development Enables Jet Planes to Fly Higher and Farther

AMERICAN jet planes are now flying higher and farther because of specially treated carbon brushes that pick up and relay power to the electrical system of the plane. Development of the new brush by Dr. Howard M. Elsey, consulting chemist at the Westinghouse Research Laboratories, was a key factor in the U.S. Air Force's program to extend the flying hours of jet planes without frequent brush replacement.

Carbon brushes are small porous blocks of carbon that convey electricity from the rotating commutator of the generator to the radio, gun turrets, and other vital auxiliaries of the plane. In the extremely dry air at 40,000 or 50,000 feet altitude, these brushes must create their own lubrication; otherwise they will grind themselves to powder against the copper commutator and the flow of electricity will stop.

Dr. Elsey solved the problem by impregnating the brushes with a special chemical compound belonging to the same family as table salt. As the brushes are pressed against the revolving commutator, the new ingredient promotes the formation of a lubricating film that prevents harmful friction at the highest altitudes attainable. Despite its tenacity, the lubricating film is so thin that two thousand layers of it would barely equal the thickness of a sheet of paper. The new chemical treatment is said to stand up under the terrific heat generated in starting jet engines, as well as in the thin, dry sub-zero air of stratosphere flying.

* * *

Molds and dies for aircraft parts are now being produced by electroforming. The process was described by M. H. Orbaugh of the Bone Engineering Corporation, in a paper presented before the Society of the Plastic Industry. Nickel or other metals are deposited on the face of a suitable matrix, usually a cast phenolic plastic, to an approximate depth of 3/8 inch, and the deposited shell is then removed. The inside surface of the metal shell forms the mold cavity.

Quick-Change Chuck for Portable Electric Tool

By HARRY CONN, Chief Engineer
Scully-Jones & Co., Chicago, Ill.

A manufacturer of bus bodies and a West Coast aircraft manufacturer encountered identical problems in using portable electric drills on their production lines. Both concerns employed chuck wrenches to operate universal chucks in which several tools were used in sequence to drill, countersink, and ream. The trouble experienced was loss of time in stopping the drill to change tools. This problem was solved by altering a No. 1 size Scully-Jones quick-change chuck so that it could be operated in any position, instead of in the customary vertical position only.

Referring to the accompanying illustration, a hole was made in the chuck collar *A* at *B* to hold a 5/32-inch ball *C*. A piece of neoprene rubber was inserted in the bottom of the hole to exert sufficient pressure against the ball to keep it pressed against the outer surface of the chuck *D*. A 3/16-inch radius groove was cut on the outer surface of the chuck. When the collar was moved forward, the ball was forced into the groove, thereby preventing the collar from vibrating and becoming disengaged. Thus the 5/32-inch ball prevented the two large driving balls *E* from escaping from the chuck *D* which held the cutting tools.

The Morse taper shank of the chuck was cut off, and an internal Jacobs taper was bored in the back of the chuck body to fit the nose end of the portable drill, as shown at *F*.

With the chuck modified as described, tools can be changed in two seconds without the aid of a wrench. Taper-shank tools can also be used, along with straight-shank tools if so desired, by employing the various combinations of adapters designed for insertion in the Scully-Jones quick-change collets. This collet arrangement enables straight-shank drills with driving flats to be driven by portable tools.

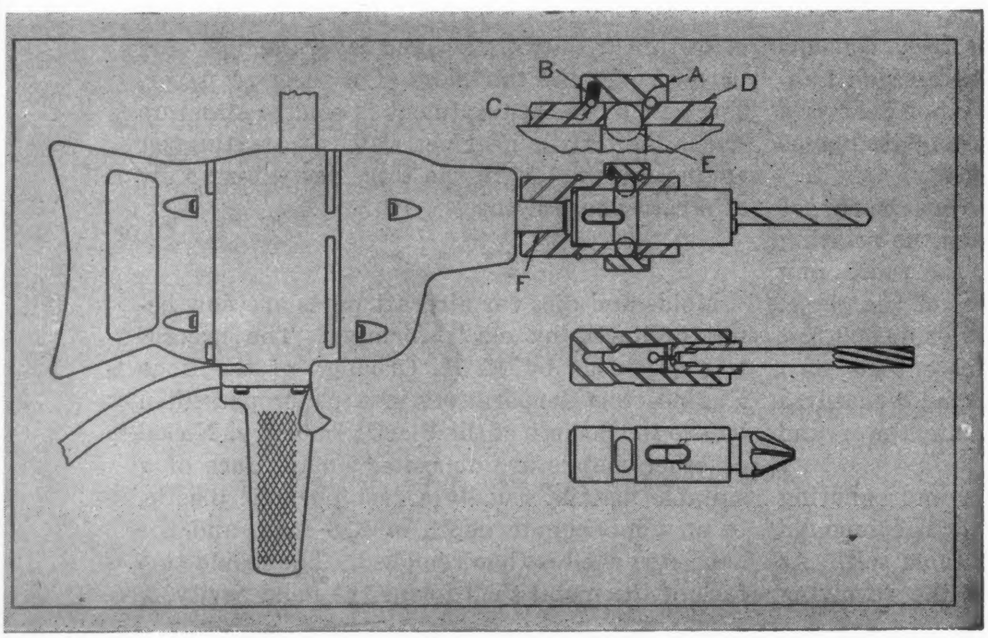
* * *

Emulsion Cleaners Replace Chlorinated Solvent Degreasers

A cleaning process for all metals has been worked out in the laboratories of Northwest Chemical Co., Detroit, Mich., utilizing emulsion cleaners based on petroleum products to replace hot chlorinated solvent degreasing. In effect, this system is equivalent to spraying the work with solvent while it is immersed in water rather than in the air.

Since these emulsions are characteristically unstable, mechanical agitation is required to maintain dispersion of the solvent in the water phase. This agitation may be induced by propeller type mixers or by a pump and jet system.

The two-phase bath is built up of petroleum solvent heated with a small proportion of Northwest addition agent No. 230. The two-phase bath can also be prepared by adding directly to the water 10 to 50 per cent Northwest emulsion cleaner No. 3. These baths may be heated to a maximum of 160 degrees F., depending upon the solvent used. The two-phase pre-cleaning must be followed by a thorough spray rinse.



Portable electric drill equipped with a quick-change chuck for use on jobs requiring frequent changes of tools

Dates Set for Westinghouse Machine Tool Electrification Forum

THE 1951 Machine Tool Electrification Forum, sponsored by Westinghouse Electric Corporation, will be held at the William Penn Hotel, Pittsburgh, Pa., on April 10 and 11.

The following papers have been announced for April 10: "Introduction to Defense," by Tell Berna, general manager, National Machine Tool Builders Association; "Conservation of Manpower and Materials," by M. S. Curtis, director of engineering, Warner & Swasey Co., Cleveland, Ohio; "Determining Factors in the Use of Hydraulic, Electrical, and Mechanical Drives," by E. J. Rivoira, executive engineer, Cincinnati Milling Machine Co., Cincinnati, Ohio; "Cushioned Starting of Alternating-Current Motors," by H. L. Lindstrom, control engineer, Westinghouse Electric Corporation, Buffalo, N. Y.; and "New Developments and Applications," by L. W. Herchenroeder, industry engineer, Westinghouse Electric Corporation, East Pittsburgh, Pa. A report of the Electrical Committee of the N.M.T.B.A. will be made by its chairman, J. J. Jaeger, assistant chief engineer, Pratt & Whitney Division Niles-Bement-Pond Co., West Hartford, Conn.

On April 11 there will be a discussion of priorities and allocations by a representative from the Machinery Division of the National Production Authority, Washington, D. C. Papers to be presented will include: "Temperature Ratings of Motors," by W. H. Formhals, section manager, Alternating-Current Motor Engineering Department, Westinghouse Electric Corporation, Buffalo, N. Y.; "Press Control," by K. B. Rexford, electrical engineer, the Hydraulic Press Mfg. Co., Mount Gilead, Ohio; and "Wiring and Wire Grouping on Large Machines," by William Stuebbe, chief electrician, the G. A. Gray Co., Cincinnati, Ohio.

Open forum discussions and plant inspection trips will follow the meeting. There will be a banquet on the evening of the second day, at which the speaker will be Dexter M. Keezer, Director of the Department of Economics, McGraw-Hill Publishing Co., New York City.

* * *

We have 600,000 more business and industrial establishments today than in 1941.

Paul Wooton, chairman of the executive committee of the Society of Business Magazine Editors, receiving the Silver Quill Award of the National Business Publications from the hands of President Truman. The occasion was the Business Mobilization Dinner held by the Society of Business Magazine Editors on January 19 at the Hotel Statler in Washington. Mr. Wooton received the award for distinguished services to the business press through his development of better understanding and more productive cooperation between the various agencies of the Federal Government and trade, technical, scientific, and professional publications of America

Wide World Photo

THE SALES ENGINEER AND HIS PROBLEMS

By BERNARD LESTER
Lester and Silver
Sales Management Engineers
New York and Philadelphia

Hot Spots in Selling Today

NECESSITY is the mother of invention, and military preparation is now a necessity. The exigencies require new designs, new production short-cuts, substitution of materials, use of untrained operators, and bolstering up of old machines. All these things must be kept in mind by the sales engineer today.

Few really new basic ideas have developed in the science and art of selling since the mountains were formed. Fundamental human reactions have remained much the same throughout history. But enormous changes have taken place in opportunity, as well as in the techniques and tools used by the salesman.

The most successful salesman is the one who can rapidly adjust his actions to change in tempo and needs of the times. In what ways can the salesman improve selling methods to conform with these revolutionary times? What special concentration is required? What direct-hitting arguments can be used? Here are some of the points that must be considered:

1. Increased scarcity of material abruptly confronts almost every prospect and customer. This scarcity makes waste a nightmare. High priority is placed upon every machine that will save waste, or assist in waste recovery. What was termed "scrap" is now held under the microscope with inordinate suspicion. This raises an important question in regard to the machine we are selling. Saving of material—perhaps only a "warm" selling point before—is now "red hot."

2. Increased scarcity in personnel now makes skilled help like a pool of water in the desert. Military demands hasten evaporation. This raises a vital question in the mind of every prospective purchaser: "What will I do when I lose an experienced operator and substitute a green hand?" For us as salesmen, it means, "How simple and easy is it to run my machine? How quickly can a man learn to do the job safely and well? Can a man tend three of my machines in place of two?"

3. Production—that's what is so real to every owner and operator. Can I get maximum production and maintain the machining limits demanded? This means the crucial factor of selling quantity results. Have the past established speed limits of my machine been too conservatively stated?

4. Getting ready. Formerly the official at the track meet deliberately called: "Get ready"—"Get set," and then, after an interval, pulled the trigger. Today, in industry, one command immediately follows the other. With his eyes fixed on the importance of getting production going, the salesman today must consider all time-consuming elements—methods of packing and shipping; time needed to unload and install; time required to achieve the maximum production rate.

5. We as salesmen must shorten our sales story. It may be far from a lullaby, and must resemble more a military march with lots of staccato. Engineering buyers are in a race against time. They can't listen to a long-winded discussion. They want facts briefly stated and only those facts that are related to their immediate interests.

6. Plan time and route of travel. Focus upon whom you must see. New plants and new prospects now take us out of our accustomed lines of travel, but don't forget others on the route. One New England machinery builder, for instance, now has an airplane available to take men at a moment's notice to a prospect or customer. Though few of us can have our own plane for travel, we can meet the urgency with planning and dispatch.

7. In any crucial period of getting a productive process going, there is not much time for experimentation or trial. But the salesman who knows

his machine, and also knows production, and who has his eyes open to see what others are doing can make suggestions and often disclose alternatives. This will be remembered for a long time by the purchaser. Help, when needed, leaves a lasting and favorable impression.

What is needed today is dynamic and resourceful selling. It is the type of selling that focusses upon those "hot spots" confronting the buyer right now.

* * *

New Hidden-Arc Welding Process

A process that extends the advantages of automatic hidden-arc welding to jobs where the joint is in other positions than that suitable for down-hand welding, has been developed by the Lincoln Electric Co., Cleveland, Ohio. This method utilizes new welding equipment, and overcomes the difficulty of directing the electrode and retaining flux and molten metal in a joint that is not lying flat. With this process, the plate being welded can be held in any position from flat to vertical, the joint being horizontal.

Since joints can be positioned horizontally, welds from both sides of the joint can be made simultaneously, as shown in the accompanying illustration. This reduces the actual arc time on a joint by about 50 per cent, and results in lower direct labor costs. Positioning each weld for down-hand welding is also eliminated, thus reducing handling and set-up time.

The new process, referred to as "3 o'clock" welding, permits the use of smaller sizes of electrode wire than can be employed with conventional methods. For example, where a 7/32-inch diameter electrode would be used on a down-hand application, a 3/32- or 1/8-inch diameter electrode can be employed with "3 o'clock" welding. As a result, lower currents are used; less electrode wire is required; smaller quantities of flux are consumed; and welds of reduced cross-sectional area are made, thus wasting less metal in unnecessary build-ups. Welds can be made in either straight seams or following an irregular contour.

Other advantages of the new process include a minimizing of the effects of distortion and the causes of weld cracking. Tendency to burn through is reduced, and back-up strips can be eliminated where two arcs on opposite sides of the work are used. The process is useful for such applications as fabricating pipe, box sections, special I-beams and H-sections, joining clips to automobile bumpers; field erection of large outdoor storage tanks; and welding of farm machinery parts and other machine frames.

* * *

Bazooka Made of Aluminum

One of the most important military uses of aluminum to come to the forefront in the Korean War is the new 3.5-inch rocket-launching super bazooka, which our forces have used so successfully against Red tanks. The new weapon is made almost entirely of aluminum so as to be easy to handle.

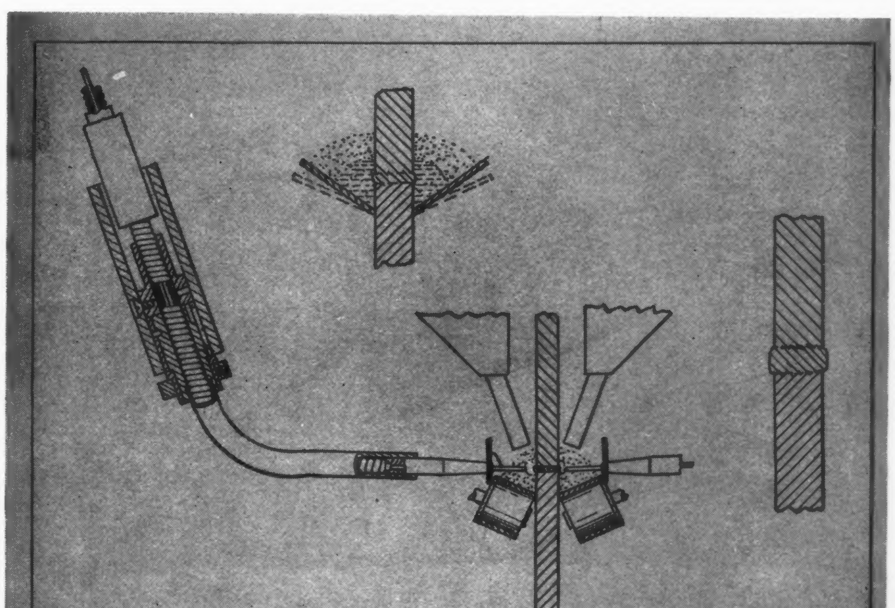


Diagram of automatic "3 o'clock" welding process, showing a horizontal seam in vertical plate being welded from both sides simultaneously. The joint remains stationary as two electrodes are moved along opposite sides of the work. Flux is carried on a moving belt

THE LATEST IN *Shop*

Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on the Market

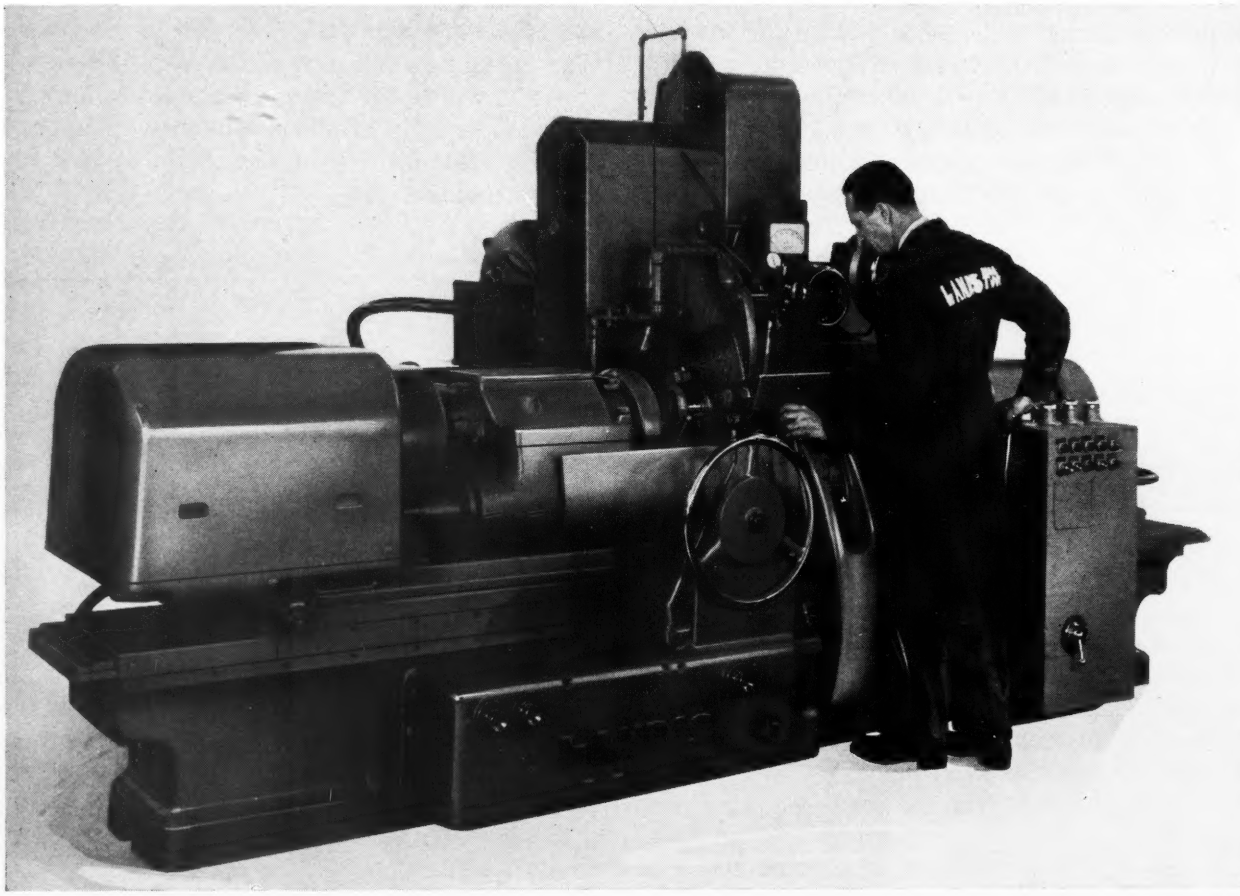
Landis Improved Crankpin Grinding Machine

The Landis Tool Co., Waynesboro, Pa., has brought out an improved precision crankpin grinding machine which is available in swings of 16 or 25 inches and in lengths to accommodate 32-, 42-, and 72-inch crankshafts. This Type DH machine is especially adapted for use by automotive plants in the high-production grinding of the crankpins of crankshafts for four-, six-, or eight-cylinder engines. It is also suitable for use in the farm machinery and aviation industries or wherever high-precision grinding of crankpins is necessary.

Refinements developed to speed up production and insure dependable operation of this improved model include separate reservoir with pump and filter for pumping lubricant to the carriage and wheel-base ways; and safety pressure switch, which prevents operation of the machine unless pressure exists in the system. If the pressure should fail, the machine motors will stop. The carriage ways are fully protected from dirt by telescoping covers, which keep the hand-scraped ways protected, regardless of the position of the carriage.

A new sensitive hand feed for the carriage is used for positioning the crankshaft laterally as the grinding wheel moves toward the work. This permits even grinding on each side of the crankshaft side wall. The oil reservoir is fully enclosed, and facilities are provided for quick filling and emptying. Gages serve to show the oil level.

Hydraulic traverse speeds are



Crankpin grinding machine of improved design brought out by the Landis Tool Co.

To obtain additional information on equipment described here, use Inquiry Card on page 235.

Equipment

Edited by FREEMAN C. DUSTON

adjustable from the front of the machine. Separate controls are provided for positioning speed of the carriage and for both right-hand and left-hand movements.

The "Microsphere" spindle bearings are lubricated by pressure, a separate reservoir for bearing lubricant being built into the wheel-base. In this case also, the system is protected by a pressure switch, which prevents rotation of the spindle unless oil pressure exists in the bearings. If the pressure should fail, the wheel drive motor will stop rotation.

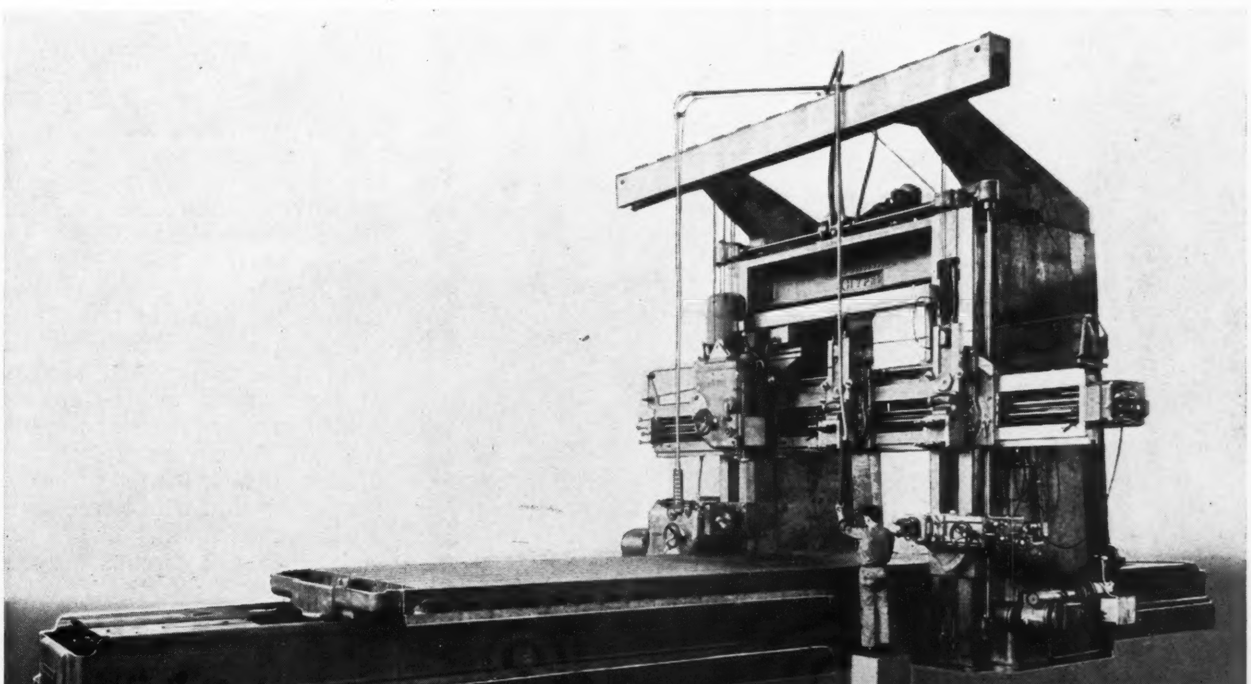
An overhead wheel-dresser can be obtained to speed up the operating cycle. This dresser is hydraulically actuated, and permits dressing the wheel without changing the work set-up. A compensating wheel feed for resetting the wheel-base to the correct position after dressing is available as extra equipment. A variable-speed motor for maintaining the correct surface speed of the wheel, regardless of wheel diameter, is also available. Automatic sizing equipment is optional. 68

Huge "Hypro" Combination Planer and Miller with Three Planing and Two Milling Heads

A new Cincinnati combination planer and miller of giant size is announced by the Giddings & Lewis Machine Tool Co., Fond du Lac, Wis. Engineering features designed to simplify the setting up and machining of huge parts and assemblies have been combined in this machine, which will take work up to 126 inches wide, 108 inches high, and 26 feet long.

The flexibility of this combination machine has been increased by mounting right- and left-hand planer heads on the rail. These heads can be operated individually or simultaneously. A right-hand planer side-head is also provided to give the machine the advantages of a conventional planer.

The rail-heads of this machine can be traversed to clear the entire table, in order to permit the effective use of a vertical milling head, also mounted on the rail. The milling head, like the planer heads, can be swiveled to reach angular surfaces on the part be-



Giant size Hypro combination planer and miller built by Giddings & Lewis Machine Tool Co.

To obtain additional information on equipment described here, use Inquiry Card on page 235.

ing machined. A left-hand milling side-head is provided to augment the regular machine functions. This head also swivels, and is capable of reaching surfaces on the side of the work-piece.

Both milling heads are designed for heavy-duty service. They have a 10-inch quill, and are individually powered with 25- to 50-H.P. two-speed motors. Each milling head has eight mechanical gear changes which, with the two motor speeds, provides sixteen spindle speeds.

The drive for feed and traverse movements of the table for milling operations is mounted on the right-hand side of the machine. This drive furnishes electronic feed to the table in infinitely variable increments from 1 inch to 60 inches per minute. A similar drive, mounted on top of the arch, supplies milling feeds to the milling head saddles of 1 inch to 40 inches per minute in infinitely fine increments.

Electronic feed is also available for the cross-rail in an up and down direction at the rate of approximately 1/4 inch to 10 inches per minute. This rate of feed readily permits the use of a right-angle milling attachment with a standard milling head, thus enabling the machine operator to reach irregular surfaces.

On the left side of the machine is mounted a 75- to 125-H.P. planer drive, which supplies planer speeds to the table ranging from 6.7 to 200 feet per minute. Speeds can also be controlled between these two limits in infinitely fine increments.

The planer side-head and milling side-head are counterbalanced by weights inside the columns. The left-hand rail milling head is counterbalanced with a special arrangement that fully romoves its weight from the rail. This traveling type counterbalance has the balance weights located on the rear edge of the housings. The two planer rail-heads have counterbalanced slides that permit them to be easily raised and lowered.

Other features of the new Hypro combination planer-miller include non-metallic table ways; forced lubrication to the table ways; complete herringbone-gear table drive; dual rail control; centralized saddle control; precision adjustment handles; power cross-feed to planer side-head; separate pendent control for planer and milling operations; and other standard Hypro features. 69

Brown & Sharpe Automatic Cutting-Off Machine

An automatic cutting-off machine with an opposed spindle that is driven in the same direction and at the same speed as the work-spindle, is a recent product of the Brown & Sharpe Mfg. Co., Providence, R. I. The spindle arrangement of this machine is designed to support and drive the work at both ends, so that the pieces are cut off cleanly, without leaving any small projections to be removed in a second operation.

The hole through the largest regular feeding finger is 3/8 inch in diameter. A single movement of the feeding mechanism feeds the work any length up to 1 inch. Successive movements can be employed for feeding greater lengths up to 4 1/2 inches. Additional equipment for increased capacity can be furnished at extra cost when required. Feed-tubes of 1/2-inch capacity for light to medium work and lining tubes for 3/32- to 5/16-inch diameter stock are available for the opposed spindle.

The machine is driven by a 2-H.P. constant-speed motor with push-button control. The spindle is mounted on precision anti-friction bearings, and has sixteen speeds ranging from 454 to 5000 R.P.M. Operation of the collet and feeding mechanisms is automatically controlled by dogs on the carrier on the cross-slide camshaft. The normal speed of the driving shaft is 240 R.P.M., but a pulley is also provided which reduces the speed to 120 R.P.M.

The cross-slide camshaft at the front of the machine and the shaft at right angles for the opposed spindle cam are driven in unison through change-gears from the driving shaft at the rear. Change-gears furnished with the machine give production rates of 3/4 second to 45 1/2 seconds for one piece per cycle of cams.

An automatic oiling arrangement, which starts when the machine is operated, provides forced-feed lubrication to the most important bearings. The fabricated steel base has a coolant oil reservoir of 5 gallons capacity. A chain-driven geared pump with pressure relief valve provides a

Brown & Sharpe opposed-spindle type automatic cutting-off machine

To obtain additional information on equipment described here, use Inquiry Card on page 235.

smooth, ample flow of oil. The machine requires a floor space about 41 by 80 1/2 inches, and weighs about 1600 pounds. Additional equipment available at extra cost includes an automatic rod magazine; silent stock support; and vertical slide attachment. 70

Rotary "Mill-Broach" for Finishing Port Pads on Automotive Exhaust Manifolds

A rotary "Mill-Broach" designed to rough-mill and finish-broach the three port pads on automotive exhaust manifolds has been built recently for a large automobile manufacturer by Cincinnati Milling and Grinding Machines, Inc., Cincinnati, Ohio. With this machine, the total cycle time for finishing the port pads on an exhaust manifold is only 0.3 minute.

The hydraulically operated fixtures with which the machine is equipped are designed to hold both right- and left-manifold castings. A cutting speed of 250 feet per minute is used for the carbide-tipped milling cutters. Approximately 1/4 inch of stock is removed by milling, and about 0.007 inch by the finish-broaching operation.

The operating cycle consists of rapidly advancing the milling cutter ram, which requires 0.02 minute; milling three pads while unloading and loading the idle fixture, 0.17 minute; rapidly raising spindle-carrier, 0.01 minute; and indexing table counter-clockwise while simultaneously finish-broaching three pads, rapidly returning ram, and lowering spindle-carrier, 0.10 minute. Thus the total cycle time is only 0.30 minute.

Fig. 1 shows a finished manifold at the loading and unloading station and the table indexed into position ready for the milling cutter ram to advance and rough-mill the three pads of a manifold in the work-holding fixture. The broach-holder can be raised, as seen in Fig. 2, to permit inspection and replacement of broach inserts. 71

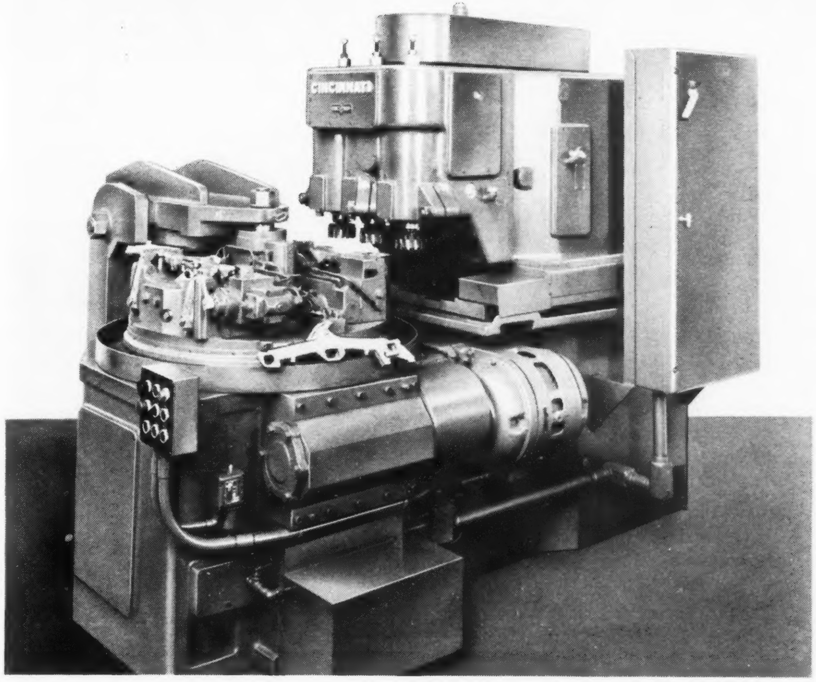


Fig. 1. Rotary "Mill-Broach" built by Cincinnati Milling and Grinding Machines, Inc., for rapidly finishing port pads on exhaust manifolds

Dayton Rogers Adjustable Spacing Collars

Improved micrometer adjustable spacing collars for milling machine cutter-arbors, which make it possible to space cutters to a high degree of accuracy are being manufactured by the Dayton Rogers Mfg. Co., Minneapolis, Minn. In using these collars, the accurate spacing of the cutters is easily accomplished by merely loosening the cutter-arbor nut and making the plus or minus adjustment of the collar with the special spanner wrench.

Although the spacing collars are calibrated in thousandths, an adjustment of a quarter-thousandth can be easily obtained by visual calibration. These collars are made in sizes for all standard

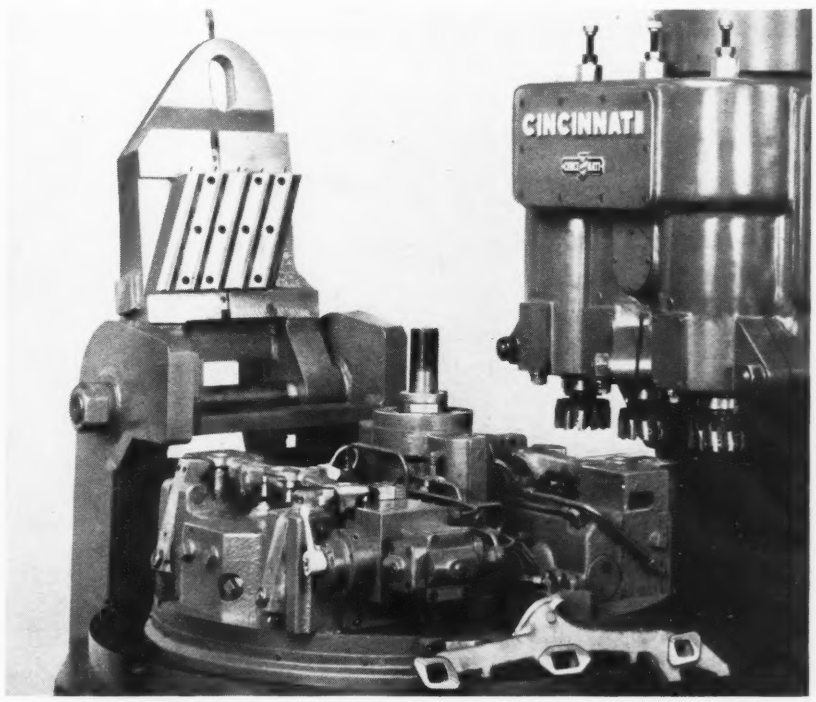


Fig. 2. Broach-holder on machine illustrated in Fig. 1, shown in raised position to permit inspection and replacement of broach inserts

To obtain additional information on equipment described here, use Inquiry Card on page 235.

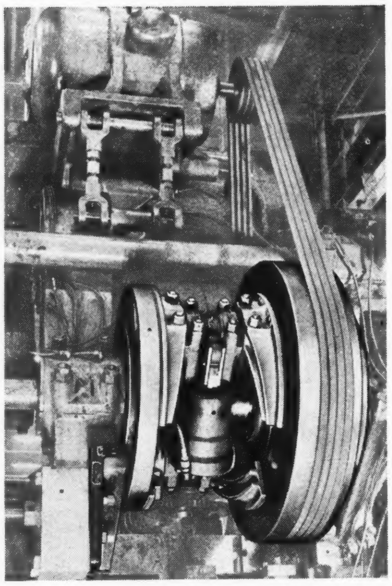
milling machine arbors from 7/8 inch to 2 inches, and have a maximum adjustment of 3/16 inch by thousandths. They are provided with new high-speed keyways. 72

Ipsen Bright Heat-Treating Furnace

A new semi-automatically controlled atmosphere unit for bright heat-treating with a rated capacity of 100 pounds an hour has been announced by Ipsen Industries, Inc., Rockford, Ill. This furnace has a hearth 12 inches wide by 18 inches long by 10 inches high. The maximum operating temperature is 2100 degrees F. The unit is designed for bright heat-treating, carburizing, carbonitriding, annealing, and brazing.

The furnace is sealed to a combination cooling chamber and quenching tanks. Work is manually loaded into the furnace, and the transfer from the furnace to the cooling or quenching section of the unit is accomplished without breaking the atmosphere seal.

The electric heating equipment consists of eight bars with an input rating of 16 K.W. The cooling chamber is water-jacketed, and has automatic temperature control. The quench tank has built-in oil heating and cooling coils with automatic temperature control. A pneumatically operated elevator is used in quenching. All doors are pneumatically operated. 73



Clutch and brake unit shown in driving position on multiple-station progressive type automatically fed press

Air-Powered Friction Clutch and Brake Unit

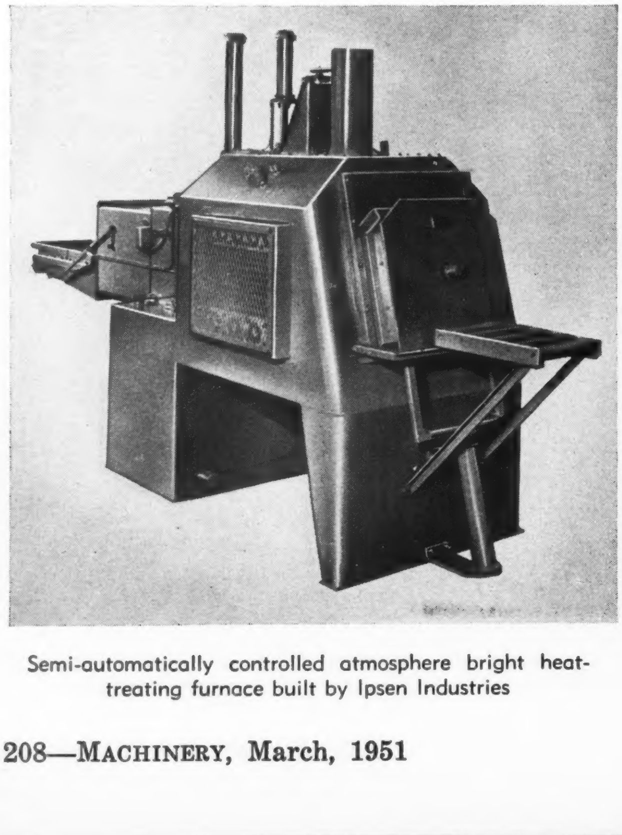
A new air-powered combination friction clutch and brake unit for use in driving medium- and heavy-duty machinery has been developed by Power Presses, Inc., Cleveland, Ohio. Features designed to provide accessibility and reduce "down time" and maintenance costs include shoe and lining assemblies which can be changed quickly without removing the unit from the machine; and provision for removing all other wearing parts, such as the driving mechanism, pistons, piston packings, and springs, while the clutch is mounted on the machine without the use of special tools and without removing other parts.

Maintenance cost is said to be further reduced because the wear is practically limited to the linings, since simultaneous engagement of the brake and clutch is impossible. The entire unit is controlled by a solenoid valve which admits compressed air to the clutch to engage its friction members. Should the air line or electric current fail, the valve immediately closes, permitting compressed air in the clutch to escape and causing the brake springs to disengage the clutch and engage the brake.

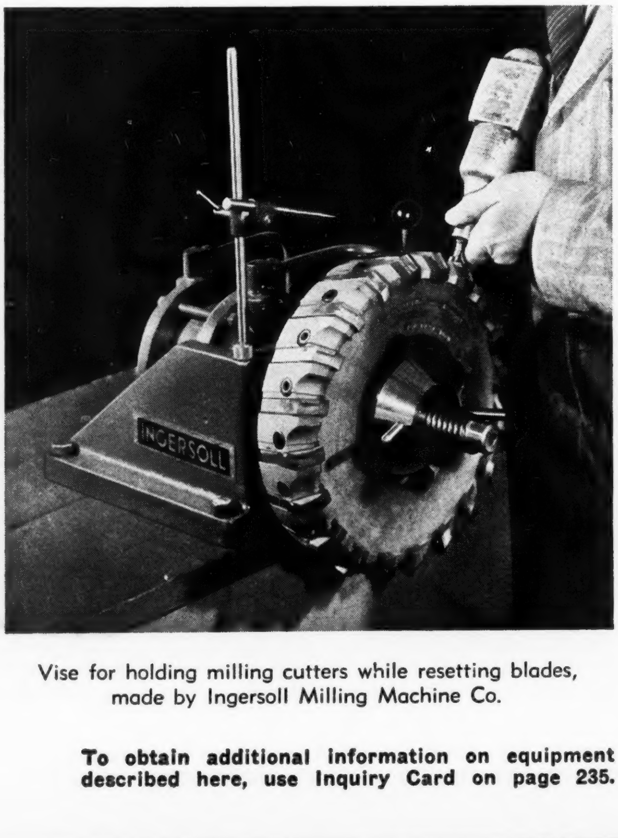
The clutch and brake unit can be used on presses of all kinds, power shovels, wire drawing equipment, slitting machines, and rolling mills. This new equipment is available in single clutch and single brake units. 74

Vise for Holding Inserted-Blade Milling Cutters while Resetting Blades

The Ingersoll Milling Machine Co., Rockford, Ill., has brought out a vise for holding inserted-blade milling cutters firmly in a convenient position while the



Semi-automatically controlled atmosphere bright heat-treating furnace built by Ipsen Industries



Vise for holding milling cutters while resetting blades, made by Ingersoll Milling Machine Co.

To obtain additional information on equipment described here, use Inquiry Card on page 235.

blades are being reset. With the cutter rigidly clamped, wedges can be driven and screws tightened more rapidly. The power-operated jaws of the vise are opened and closed by an air-pressure valve. A pointer mounted on the vise is used in setting blades to the same height.

Arbors for cutters with 1 1/2-inch and 2 1/2-inch diameter bores are standard equipment; arbors for other sizes are available as special equipment. 75

Fauver "Lubrikit" for Reloading Bearings and Grease Reservoirs

Individual bearings and centralized lubricating systems of machinery can be easily replenished or reloaded with lubricant by a new "Lubrikit" built by the J. N. Fauver Co., Inc., Detroit, Mich.

The kit consists of an electrically operated barrel pump, mounted on a 400-pound grease drum, for use in filling grease reservoirs; a hand transfer pump on a 100-pound drum for the delivery of oil; and a tool-box containing hand tools, miscellaneous fittings, and hand guns for servicing individual bearings. The necessary hose, nozzles, and gages are included, the entire unit being mounted on a steel base 30 by 60 inches provided with casters....76

General Electric power supply unit for converting alternating to direct current

G-E Metal-Enclosed Direct-Current Power Supply Units

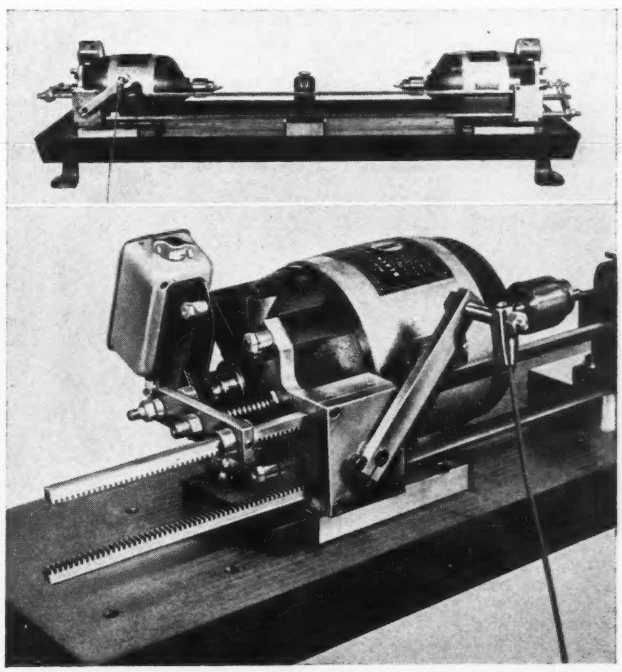
A line of metal-enclosed direct-current power supply units utilizing selenium rectifier stacks has been announced by the General Electric Co., Schenectady, N. Y. This new conversion equipment can be used for excitation of synchronous motors; operation of direct-current elevators, cranes, and machine tools; and converting of alternating-current feeders to direct-current operation. The rectifier units are designed for indoor installation. They are enclosed in a metal casing consisting of one to four separate sections.

The new units can be furnished to supply either 125 or 250 volts direct current from a 208-, 230-, or 460-volt, three-phase, 60-cycle alternating-current supply line. Convection-cooled units are available in ratings of 0.75, 1.5, 3, and 5 kilowatts. Fan-cooled units are rated at 7.5, 10, 12.5, 15, 18.5, 20, and 25 kilowatts. When larger ratings are required, two or more rectifier units can be connected in series or in a combination of series and parallel to increase the current or voltage rating of the installation. 77

Black Countersinking Machine with Improved Tool Controls

The latest model countersinking and deburring machine manufactured by the Black Drill Co., Cleveland, Ohio, is equipped with a positive type tool-actuating mechanism that permits precision operation on a wide variety of work up to the full 20-inch capacity of the machine. The new control consists of a double rack-and-pinion traversing mechanism operated by a foot-treadle. Each rack carries an arm fitted with a micrometer ad-

"Lubrikit" with grease and oil drums, electrically operated pump, and fittings for quick reloading of bearing and grease reservoirs, made by J. N. Fauver Co., Inc.

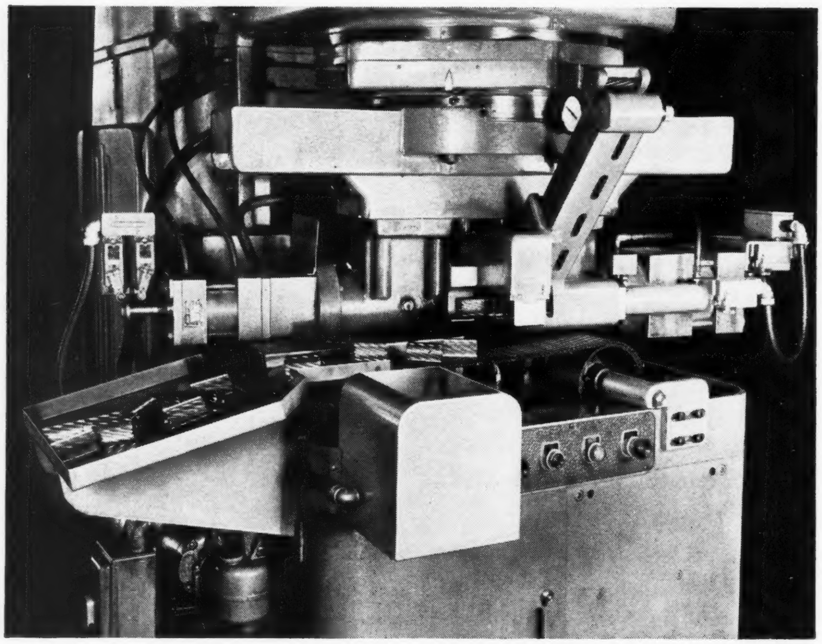


(Upper View) Black countersinking and deburring machine. (Lower View) Close-up view of motor and controls for motor-shaft movement and cutting depth of machine

To obtain additional information on equipment described here, use Inquiry Card on page 235.

justing stud which transmits pressure to the motor-shafts. These arms are quickly adjustable by set-screws to any rack position, while a stop on the lower rack limits the travel of both motor-shafts.

Operation of the new machine is simple. When power is supplied to the two traversing shaft motors, the rotors automatically position themselves in the center of the magnetic fields in the stators and remain there. With the work in place, pressure on a foot-treadle is transmitted through a cable, arm, and pinion to produce movements of the racks in opposite directions. These racks, through the attached adjustable control arms, bring equal pressure to bear at the ends of the motor-shafts, causing them to move in the stators and thus advance the tools into the work simultaneously.....78



Automatic unloading chute applied to Michigan rotary gear-shaving machine

Automatic Unloading Attachment for Rotary Gear-Shaving Machines

A new low-cost, self-contained, automatic unloading attachment for rotary gear-shaving machines has been introduced by the Michigan Tool Co., Detroit, Mich. This unit is especially adapted for unloading small gears when automatic loading is employed. The accompanying illustration shows a typical application of the unloader, the guards having been removed from the machine to permit a clearer view.

The unloader consists of a wire-mesh belt which travels over two drums. The drive is from a small electric motor. Slots in one of the mounting brackets permit adjustment for taking up slack in belt.

As the wire-mesh belt moves at a relatively low and constant speed, it permits cutting fluid to drain back into the machine before the gear is discharged into the collecting pan. It also has a certain amount of give, which prevents damage to the finished gear, either from striking a solid metal chute or another gear. The metal in the belt is softer than that of the gears and will not damage the work.

The unloader can be quickly attached to 870 or 870A Michigan Tool Co.'s automatic gear finishers in any of several positions. No changes in the machine are necessary except to drill and tap a few holes for mounting brackets and the discharge chute. 79

"Air-Gage Tracer" for Monarch Lathes

The Monarch Machine Tool Co., Sidney, Ohio, has developed a new type of single-cylinder "Air-Gage Tracer" incorporating modifications in design that better adapt it for use on 12-, 16-, and 20-inch Series 60, Models M, N, and NN Monarch engine lathes. This new design, identified as Type C, has a built-in hydraulic cylinder,

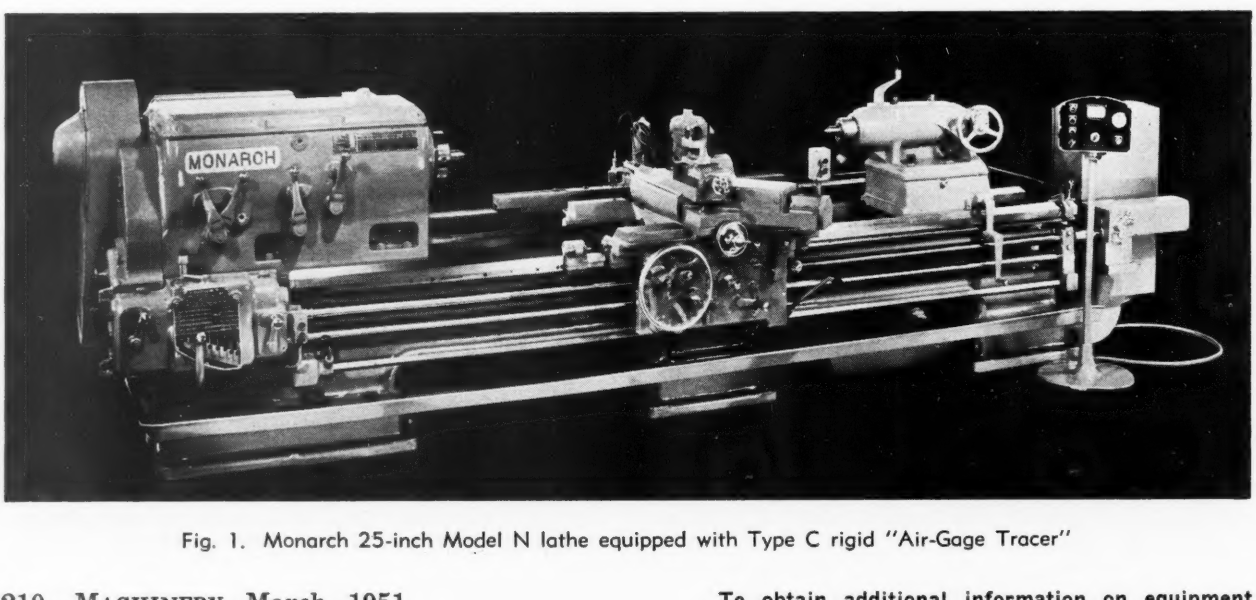


Fig. 1. Monarch 25-inch Model N lathe equipped with Type C rigid "Air-Gage Tracer"

To obtain additional information on equipment described here, use Inquiry Card on page 235.

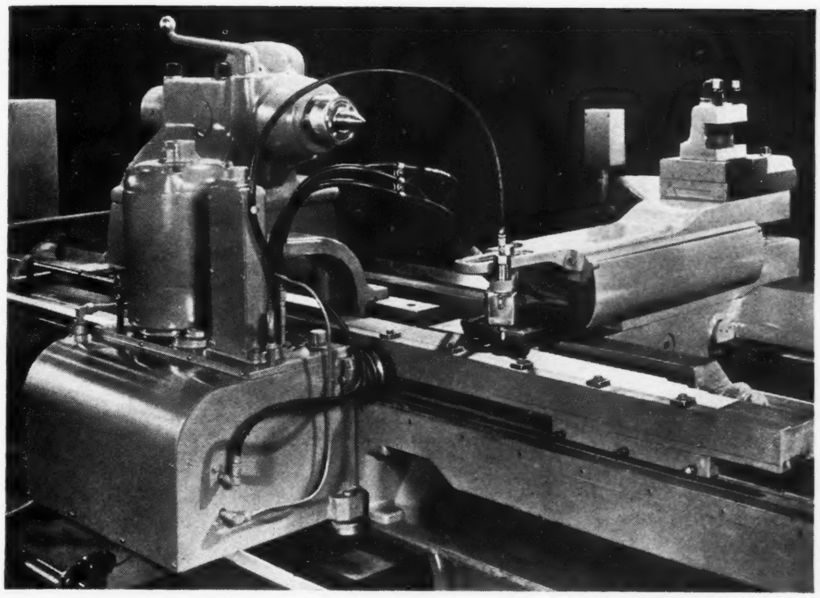


Fig. 2. Rigid "Air-Gage Tracer" with flat templet applied to heavy-duty Monarch lathe

which lends great compactness and rigidity to the slide mechanism, permits exceedingly short hydraulic and air lines, and provides a power unit that travels with the carriage on a track at the rear of the templet support.

Introduction of the traveling power unit has several outstanding advantages, the most important being that there is no limit on the length of lathe to which the new "Air-Gage Tracer" can be applied. Shortening of hydraulic and air lines increases the accuracy of its operation and also improves the general appearance of the installation, as shown in Fig. 1.

Because the templet support rail is mounted low at the rear of the bed and the tracer supporting arm extends to the rear beneath the work, extra large and extra long work can be loaded and unloaded with the same ease as on any conventional lathe. Ample power to hold and to drive the cutting tool is provided by the large built-in hydraulic cylinder. As a consequence, rate of feed and depth of cut are limited only by the cutting tools and the size of the lathe used.

All "Air-Gage Tracer" equipped Monarch lathes can, of course, be used as manually operated machines for the usual turning, boring, facing, and threading operations. On the new Series 60 lathes, the switchover to manual operation has been simplified by centralizing controls in a small three-position lever at the front of the hydraulic slide. With the lever in the "stop" position, the slide is locked hydraulically, permitting the stylus to be removed, so that it will clear the templet or templet support, after which manual lathe work can proceed.

To reinstate the "Air-Gage Tracer" control on the machine, the lever is simply thrown to the "automatic" position, and the stylus is replaced. The third position of the lever—"reverse"—permits the operator to withdraw the slide quickly when desired.

Air-Tracer pressure against the templet is only about 5 ounces. As a consequence, there is no need to harden the templet to protect it against wear. Either a flat templet, as shown in Fig. 2, or a round templet, Fig. 3, can be used for thousands of work-pieces without appreciable wear taking place. The flat templet is often preferred for the longer production runs that are repeated frequently, because its storage for future use requires so little space. For small-lot runs, which are likely to be repeated less often, the round templet is advantageous. It can be turned manually on the lathe and then placed between centers on the templet rail, to guide the cutting tool.

The new Air-Tracer design is available in both swiveling and rigid types for application to new lathes at the factory. By far the majority of operations can be performed with the "Air-Gage Tracer" slide at a fixed angle of 45 degrees. The major advantage of the swiveling slide is in connection with boring operations. Swiveled to the maximum of 90 degrees, boring can be done at the front of the hole and with the spindle rotating in the same direction as during turning operations. The swiveling slide is also required for certain types of under-cuts, as well as for facing operations having an extreme contour range.

The swiveling design of the Type C "Air-Gage Tracer" is available optionally for the 20-

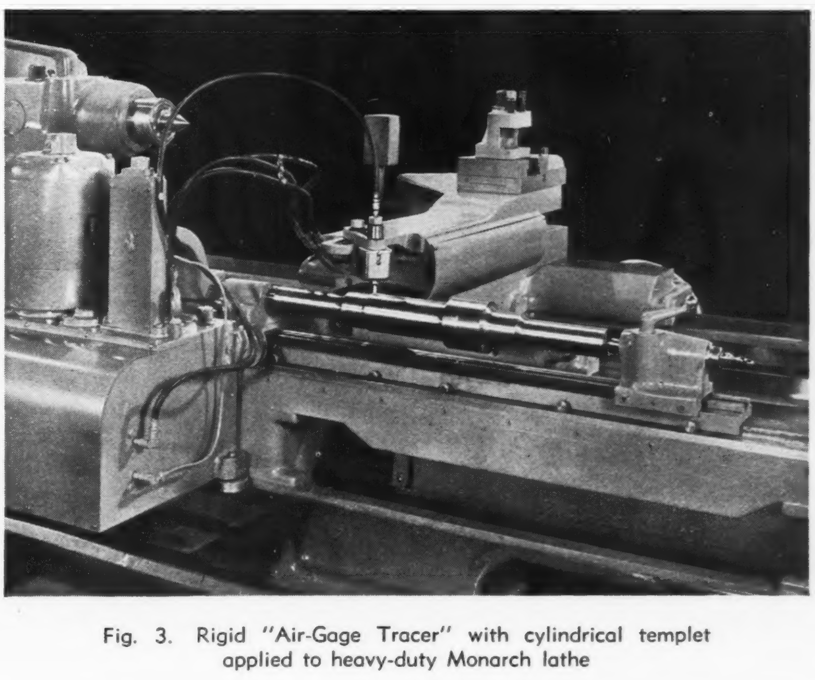


Fig. 3. Rigid "Air-Gage Tracer" with cylindrical templet applied to heavy-duty Monarch lathe

To obtain additional information on equipment described here, use Inquiry Card on page 235.

inch Series 60 and 25-inch Model N Monarch lathes. The Type B swiveling design (with over-arm) is the only "Air-Gage Tracer" obtainable on the 10-inch toolmaker's and the 10-inch precision manufacturing lathes. Both Type C rigid and Type B swiveling design tracers can be supplied on the 32-inch Model NN lathes. 80

Arter "Imperia" Carbide Tool Grinder

Novel operating features have been incorporated in a carbide tool grinder recently placed on the market by the Arter Grinding Machine Co., Worcester, Mass. In this machine, known as the Model 200 "Imperia," the tool is held by hand or in a holder on one of the two work-tables provided, and is moved across the face of the grinding wheel by a pivot-jointed parallelogram movement of the work-table.

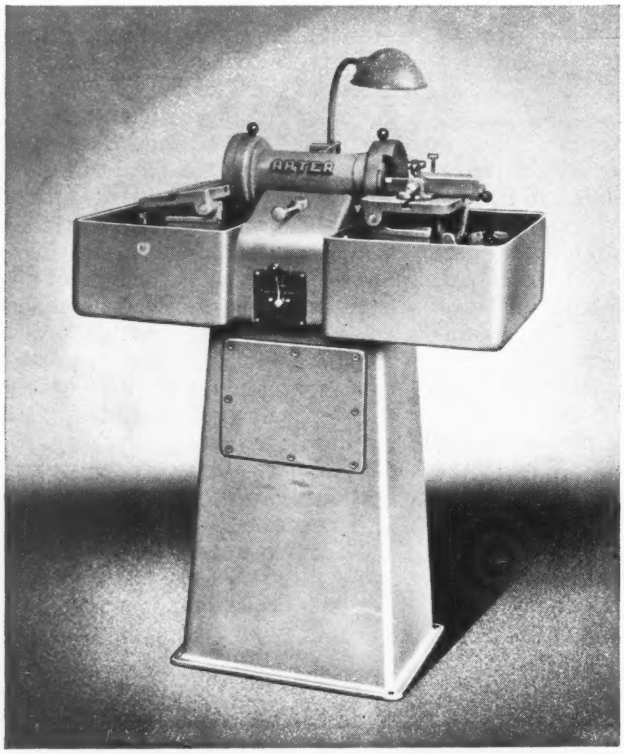
The work-tables operate under spring-tension, and can be moved fast or slow, with long or short strokes. The action is similar to honing, and produces a fine polished surface. Tool feed can be accurately controlled by means of the screw feed to the work-table.

Chip-breakers are ground with the table locked. By moving the wheel and its spring-tension arm up and down, a chip-breaker surface can be ground parallel or at an angle to the cutting edge of the tool.

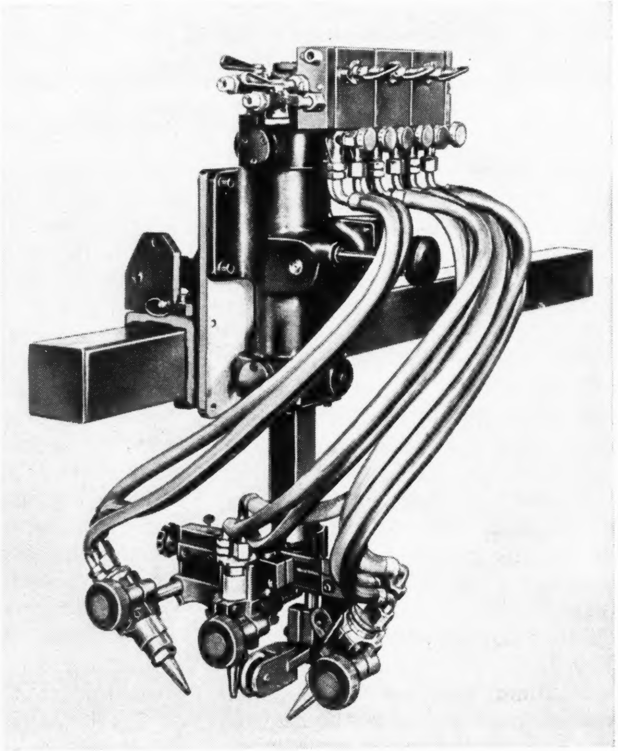
The work-tables can be tilted to the required angle, and the protractor type tool-holders set to locate the tools in the correct angular position with respect to the wheel. This method permits repeated grinding of the tools to specified angles. Rough or uneven tool shanks or worn machine tables will not affect the accuracy of the operation, as there is no sliding of the shank on the table. The screw feed also provides a uniform movement, thus eliminating the danger of too heavy feeding pressures.

Standard equipment includes a 3/4-H.P. motor, coolant system and pump, and protractor tool-holder, but no grinding wheels. Diamond wheels 6 inches in diameter, with 3/4-inch wide face at rim and spindle hole 1 1/4 inches in diameter, can be furnished with the machine at extra cost. The grinding wheels are used at a speed of 6000 surface feet per minute.

The work-tables are 16 3/8 by 7 3/4 inches, and have a horizontal movement of 2 1/8 inches and an in-feed of 0.030 inch. Tool shanks up to 1 1/2 inches wide by 1 1/2 inches high can be held. The grinding wheel has a vertical movement of 1 3/4 inches. The machine is 36 inches long by 27 inches wide by 48 inches high, and weighs 600 pounds. 81



Carbide tool grinder introduced on the market by the Arter Grinding Machine Co.



Airco device for cutting single or double bevel on plate edges preparatory to welding

Airco Plate-Edge Preparation Device

Air Reduction Sales Co., Division of Air Reduction Co., Inc., New York City, has announced a new plate-edge preparation device for gas-cutting plate edges to the bevel required for proper joining by welding. This device has been designed to increase production and insure clean-cut, accurate preparation of plate edges with either a single or double bevel, and with or without a land. It employs a spring-balanced, free floating carriage and caster wheel assembly to permit cutting the bevel over plate undulations while maintaining a constant tip-to-work distance, and can be mounted on any gas-cutting machine having a 3-inch square torch bar.

To obtain additional information on equipment described here, use Inquiry Card on page 235.

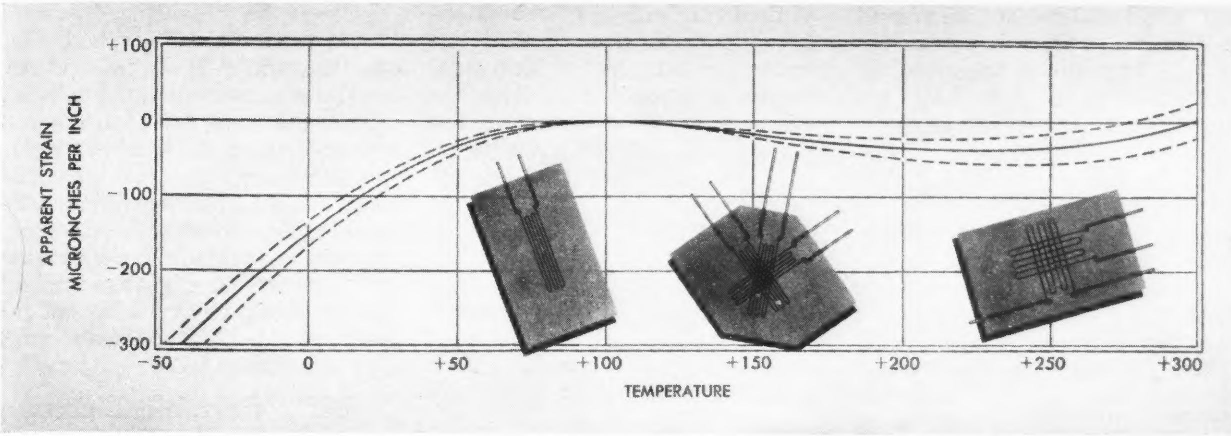


Chart showing characteristics of new temperature compensating strain gages announced by Baldwin Locomotive Works

Torches can be independently positioned vertically or laterally without changing the bevel angle. Fuel and preheat pressures are initially set with individual torch valves, and once set, the master valve controls turning on and shutting off of gas supply without disturbing settings of the torch valves. 82

Baldwin Temperature-Compensated Strain Gage

The Baldwin Locomotive Works, Philadelphia, Pa., has recently announced a new type of SR-4 bonded resistance wire strain gage, which is self-compensating for temperature variation. These strain gages are available for use on Dural and steel in the form of single elements, double elements, and rosettes, as seen in the chart.

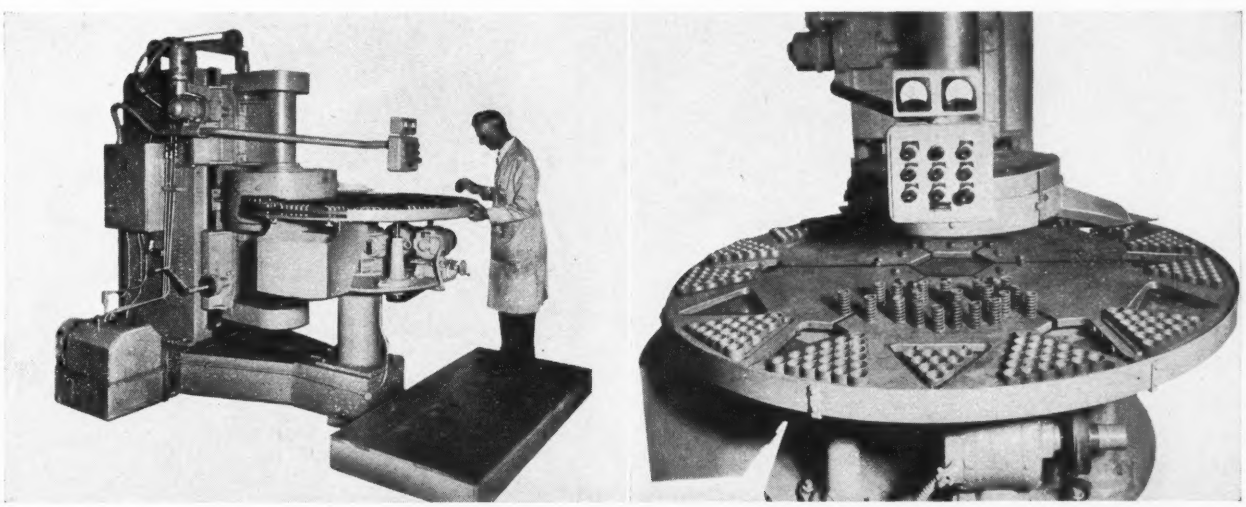
The principal advantage of this gage is the elimination of a second strain gage to compensate for temperature changes. Basically, the new gage is similar to standard Bakelite gages with cupro-nickel wire, and its application is by means of the same methods and the use of phenol-resin cement.

Gages for two temperature ranges are offered as follows: +50 to —300 degrees F., and —50 to +300 degrees F. Single-element gages are now in stock in four gage lengths of 1/4, 3/8, 13/16, and 7/8 inch. Temporarily, double elements and rosettes will be available on special order. 83

Besly Double Vertical-Spindle Spring Grinder

A double vertical-spindle disk grinder with semi-automatic cycling, designed for rapid, economical grinding of coil-spring ends with a high degree of accuracy, has been announced by Charles H. Besly & Co., Beloit, Wis. This new machine will grind springs from 1/2 inch to 6 inches long and 1/4 inch to 4 inches in diameter made from wire 0.0625 to 0.500 inch in diameter. The abrasive disks are especially constructed to grind springs of various types made from materials such as oil-tempered steel, music wire, bronze wire, etc. This eliminates "down time" for wheel change-over.

The springs pass across the center of 30-inch diameter abrasive disks which have no center holes. This eliminates "down time" for dressing, as well as abrasive loss resulting from the customary wheel truing operations. The new method also tends to eliminate the need for secondary operations, such as reaming or chamfering, squaring, and scale testing. Abra-



(Left) Besly double vertical-spindle spring grinder. (Right) View showing tube clamping method used on machine shown at left

To obtain additional information on equipment described here, use Inquiry Card on page 235.

sives and metal do not fuse around the end coils, there being an absence of heat during the grinding, and therefore, the end coils do not run over size as a result of metal flow.

Notable features include an electrically controlled hydraulic or fluid motor linked directly to the lead-screw of the top head, micro-switches which limit the up and down movement of the head, and counterweights for the top head.

The grinding cycle is extremely simple. The operator loads the slowly rotating feed-wheel, which is driven by a fluid motor. The speed of the feed-wheel is variable from 1/6 to 19 R.P.M. to suit operating conditions and is controlled by a conveniently located valve. After loading, the feed-wheel rotation is increased to grinding speed and the down feed of the top head is started by push-button control. There is little occasion for burn, as the feed-wheel rotates at a speed that allows the abrasive to remove only a few thousandths inch stock per pass.

When the required size is reached, a limit switch stops the downward travel of the head and a flashing amber light shows the operator that the grinding cycle is in the dwell or spark-out period. This period at the conclusion of the grind gives the springs a good finish and brings them to uniform size.

A traverse control button quickly returns the head to its top limit. The grinding cycle is then complete, the feed-wheel is stopped, the hinged unloading panel is dropped, and the feed-wheel is slowly rotated to unload the springs by gravity. 84

Hauser Measuring Machine

A machine for making precision measurements with direct optical readings to 0.00005 inch without the use of micrometer screws is now available from the Hauser Machine Tool Corporation, Manhasset, N. Y. Universal application, simple handling, and direct optical reading of measurements in graduations of 1, 0.1, 0.001, 0.0001, and 0.00005 inch are features of this machine.

The longitudinal and transverse travel measuring range of this machine is 4 by 4 inches. The measuring table is 9.5 by 6 inches. Microscopes for reading longitudinal and transverse travel have a magnification of 100 x. The measuring microscope, which is interchangeable with goniometer (protractor eye-piece) has a magnification of 45 x. A centering microscope, interchangeable with the graticule for locating center-punch marks with bores up to 13/64 inch in diameter, has a magnification of 35 x.

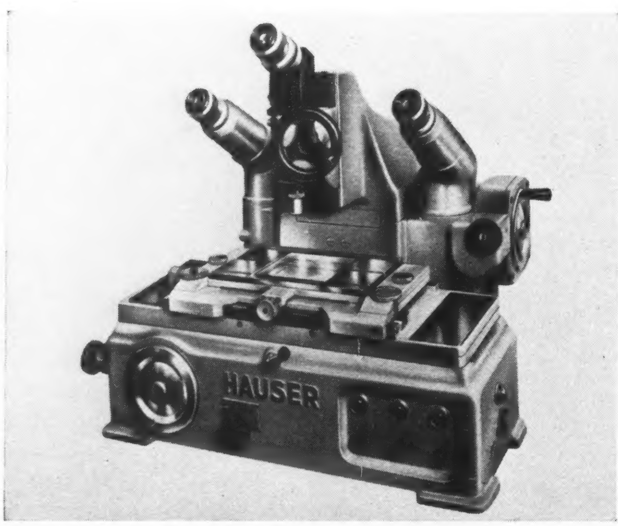
A center-punch is provided, which is positioned concentrically with the microscope carrier. An episcopic lighting attachment facilitates the use of measuring and centering microscopes. The circular interchangeable glass table is 6.3 inches in diameter. Divisions on the measuring drum are equal to 1 minute of arc, and those on the vernier 10 seconds of arc.

The maximum distance between center-points is 5.9 inches. Adjustable vees are provided for parallel support. The machine stand is 31.5 inches wide by 26 inches deep by 27.5 inches high. Provision is made for operation on single-phase lighting current of 125 to 220 volts. The weight without stand is 340 pounds. 85

"Skil" Portable Electric Hammer

Simplicity of design characterizes a portable electric hammer just brought out by Skilsaw, Inc., Chicago, Ill. This new Model 437 hammer has only one working part. The specially designed power unit consists of two alternately energized magnetic coils, which eliminates gears, cranks, and connecting-rods. The hammer strikes 3600 blows a minute, and will handle such tough jobs as drilling and channeling in concrete; vibrating concrete forms; and the chipping, scaling, and cleaning of many materials.

The 1 1/8-inch hammer has an efficient operating range, with capacity for star drills from 3/4 inch to 1 1/8 inches in diameter, and at extreme operating limits, for star drills from 3/8 inch to 1 1/2 inches in diameter. The tool is 16 1/4 inches long and weighs 20 pounds. The steel carrying case has built-in selenium rectifier, extension cord, three star drills, and other accessories. 86



Precision measuring machine announced by Hauser Machine Tool Corporation

Portable electric hammer equipment placed on the market by Skilsaw, Inc.

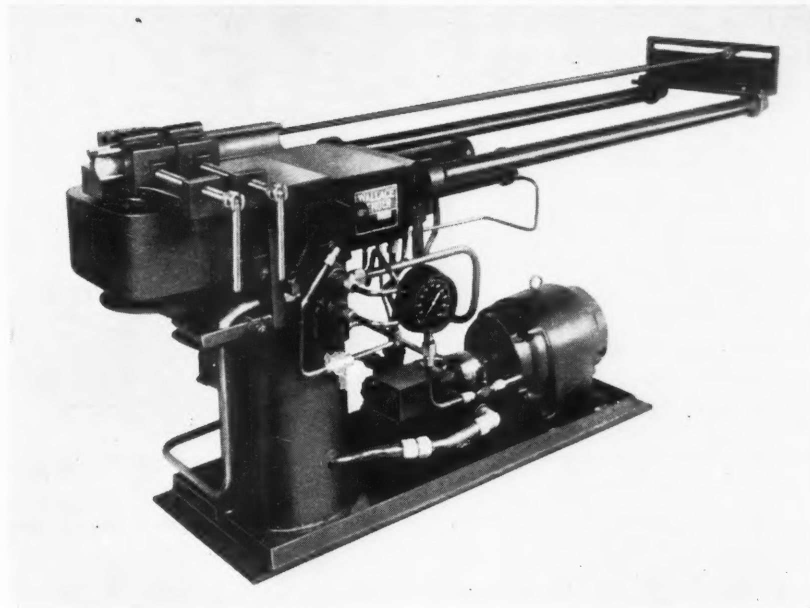
To obtain additional information on equipment described here, use Inquiry Card on page 235.

Wallace Hydraulic Bender

A small, compact production or custom bending machine has just been announced by the Wallace Supplies Mfg. Co., Chicago, Ill. This machine, designated Model No. 800, has bending power well above its rated capacity for bending steel tubing 1 1/4 inches outside diameter by No. 16 gage.

The unit is furnished with a standard 2-H.P. 220- to 440-volt three-phase, 60-cycle motor. In operation, a single lever is pushed down to cause the bending arm to swing around to the angle or degree of bend selected and remain there until the bent part has been removed. The lever is then moved up, and the arm swings back to its original position.

The bending die is held in place by spring clips, which facilitates changing dies. The die is of the combination type, handling four different sizes of work. The bender can be changed simply and easily for either right- or left-hand bending by changing the pressure and clamping arms and inserting the bolts in holes provided for the purpose. The 10-inch steel pipe column to which the top and base are welded also serves as the tank for the hydraulic fluid.



Hydraulic bending machine announced by the Wallace Supplies Mfg. Co.

The maximum radius adjustment is 8 inches. The standard mandrel extractor length is 5 feet 6 inches, but special mandrels up to 60 feet in length can be furnished. The machine, including the mandrel unit, is 21 inches wide by 34 inches high by 78 inches long, and weighs about 900 pounds. 87

Barton Flexible-Shaft Tool

Barton Products, Inc., Defiance, Ohio, has recently introduced a new flexible-shaft tool designed for a wide range of grinding, buffing, polishing, rotary filing, drilling, and other operations which can be performed with regular or special flexible-shaft tools. The flexible shaft is driven by a motor of 1/4-H.P. single-phase, 60-cycle, 110-volt size, which provides a speed of 6000 R.P.M.

The ball-bearing, high-speed hand-piece is designed for cool running, and can be supplied with either a 1/4- or 1/8-inch collet. A bail is provided for suspension of the motor at any convenient height for the work to be done. 88

Verson Magnetic Sheet Separator for Stamping Press Work

Difficulty in separating sheets of steel for feeding them into stamping presses and press brakes is eliminated by means of a new non-electric, permanent-magnet type unit recently announced by the Verson Allsteel Press Co., Chicago, Ill. This unit, known as the "Magnetic Sheet Floater," is said

Suspension type flexible-shaft tool brought out by Barton Products, Inc.

Verson magnetic sheet separator developed to facilitate handling press work

To obtain additional information on equipment described here, use Inquiry Card on page 235.

to substantially speed up sheet handling and reduce glove damage and injury to workers in the form of cuts from sharp edges of the steel sheets.

The "Sheet Floater" consists of powerful Alnico magnets, a stainless-steel mounting bracket, and a stainless-steel wearing plate welded into a single compact unit. This unit induces a magnetic field in the sheets in such a manner that they repel each other, causing the ends to float or fan out with air spaces between them. Separated in this manner, the top sheet can easily be grasped by the worker and fed into the press.

The number and size of units required and their positioning depends upon the size, weight, and shape of the sheets. Blanks and irregular shapes can also be separated. 89

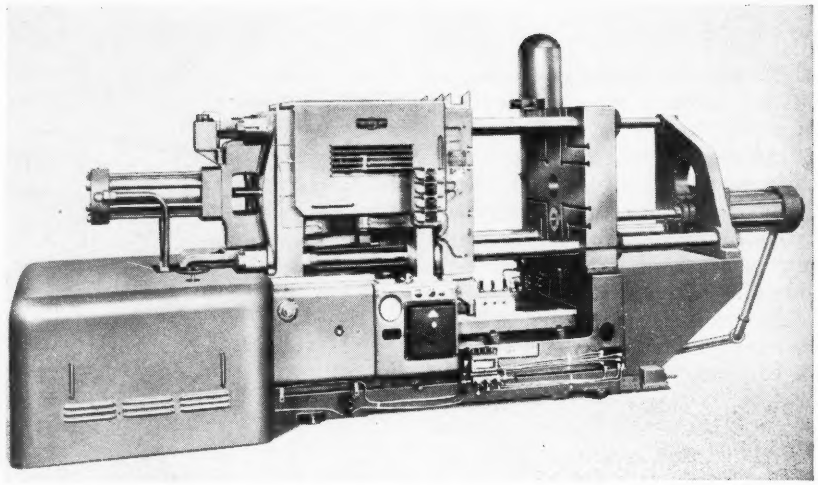


Fig. 2. Reed-Prentice die-casting machine with high-pressure cold-chamber attachment

Improved Reed-Prentice Die-Casting Machines

The Reed-Prentice Corporation, Worcester, Mass., has announced improvements in its Nos. 2 and 2G "combination" die-casting machines. The high-pressure plunger gooseneck attachment of the No. 2 model, designed for zinc, tin, or lead-base alloys (Fig. 1), is readily interchangeable with the high-pressure cold-chamber attachment of the No. 2G model, built for aluminum, magnesium, and brass alloys (Fig. 2). The die locking end of the machine, including the movable and stationary die plates, operates with either attachment. A 20-H.P. motor and larger hydraulic pump combine to provide faster machine cycles, which assure greater hourly production. The No. 2 machine has a maximum "shot" capacity of 15 pounds of zinc, while the No. 2G model has a maximum capacity of 9 pounds of aluminum.

The opening and closing of the die and other functions of both machines are controlled by a centralized station having a new type of lever, which is wide enough for either thumb or palm operation. This improved lever construction is an important safety feature. Sliding support brackets for the movable die plate assure proper alignment of the die under continuous operation, and the heavy, one-piece fabricated steel base insures machine rigidity. Positive electrical interlocks eliminate all danger of "shooting" the metal until the dies are securely closed.

Two outlets in the stationary die plate offer a choice of nozzle location and allow better distribution of metal. On the No. 2 machine, the melting pot of the newly designed furnace holds 1400 pounds of zinc. The whole furnace assembly can be lowered for use with the lower die-plate hole. The cylindrical furnace permits the use of a new gooseneck design which provides for easy removal of the gooseneck and nozzle. 90

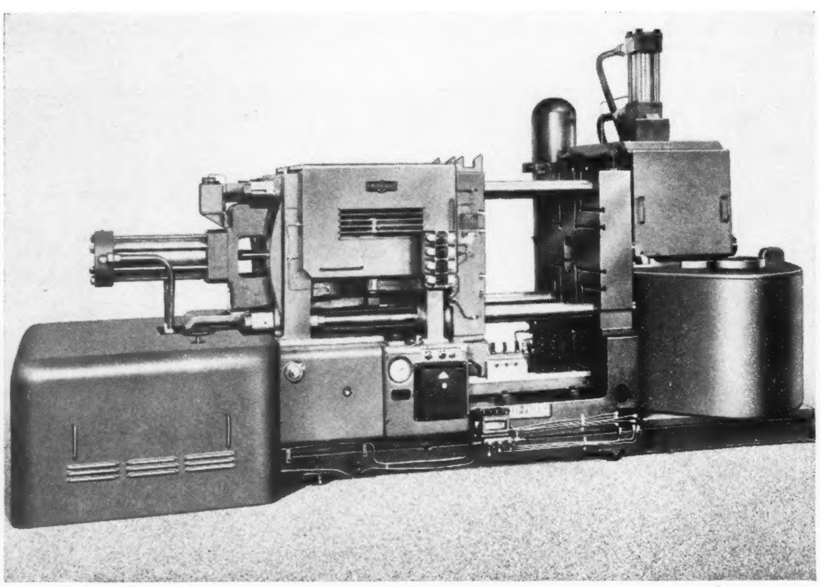


Fig. 1. Reed-Prentice die-casting machine with high-pressure gooseneck attachment

Space-Saving "Square-Design" Cylinders

"Square-design" cylinders have been developed by the Miller Motor Co., Chicago, Ill., which, in addition to their space-saving feature, have solid steel heads, caps, and mountings; scratch-resistant hard chrome-plated piston-rods; dirt wiper seals; rustproof, precision-honed brass barrels; and self-regulating, wear-compensating seals that are non-adjustable and tamper-proof.

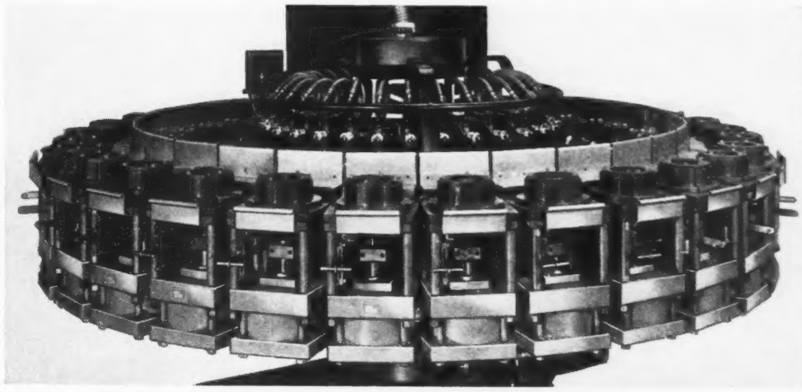
The "square-design" cylinders have been used in a special thirty-station "Cyclewelding" machine designed by Hautau Engineering Co., Detroit, Mich., for volume production of automotive transmission brake bands. This machine has been arranged to make maximum use of standard parts to facilitate replacements. Each of the thirty stations is, in effect, an independent press with its own, easily replaceable, standard ther-

To obtain additional information on equipment described here, use Inquiry Card on page 235.

mostatic controls, electrical connections, and "square-design" cylinder.

The space saved by cylinders of this design permitted the thirty stations of the machine to be built into an unusually compact, circular table having a diameter of only 9 1/2 feet, whereas circular bolted cylinders of the same bore would have required an 18-foot diameter table.

The new machine operates automatically, it being only necessary to load the rings and liners and trip the expander valve lever. The work-table then rotates at variable speeds from 3 to 6 minutes per revolution. The "Cyclewelding" operation requires temperatures of about 450 degrees F. and lining area pressures of 200 to 450 pounds per square inch. 91



Special "Cyclewelding" machine with "square-design" cylinders

Kenco Punch Press

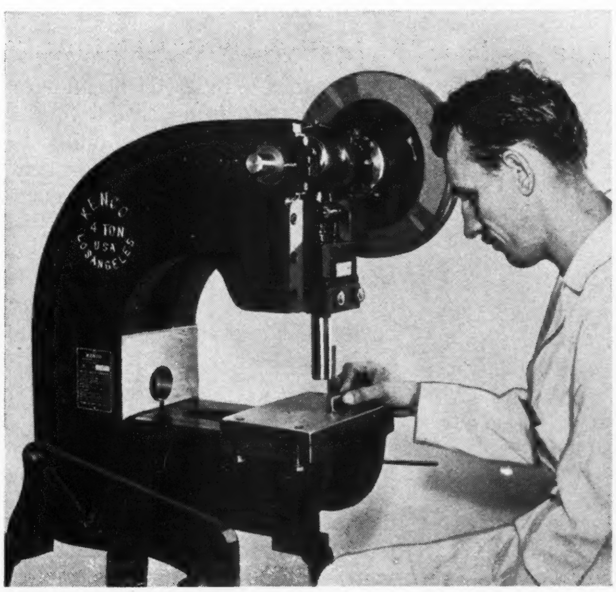
The production of a new four-in-one 4-ton punch press has been announced by the Kenco Mfg. Co., Los Angeles, Calif. Outstanding features of the new press include a deep, 12 3/4-inch throat, a 400-pound cast frame, and a patented clutch drive dog built into the clutch collar. This arrangement has been developed to eliminate weakening the one-piece shaft by deep milling. A special trip mechanism permits the operator to change from single to continuous operation without stopping the press.

An adjustable bed permits quick conversion from the standard press to the long punch or horn type press. The connecting-rod bearings are of a steel-encircled bronze-lead alloy designed to insure long life and maximum lubrication efficiency. 92

G-E "Inductrol" Power Packs

A "midget" load center unit sub-station, known as the "Inductrol" power pack, has been brought out by the General Electric Co., Schenectady, N. Y. This unit is designed especially for low-voltage, regulated alternating-current lighting and power service in factories and laboratories. It incorporates in one steel housing an air circuit-breaker, a drive type transformer, and an air-cooled induction regulator. The equipment is available in either single- or three-phase ratings. It has a capacity ranging from 15 to 100 KVA, with incoming circuit rating of 480 or 600 volts, 60 cycles, and a regulated output rating of 120-240 or 208-120 volts.

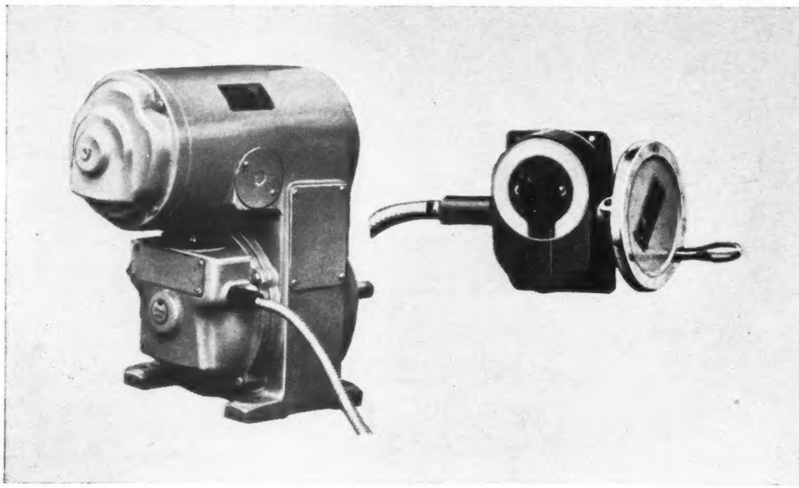
With these power regulating units, power can be brought to the load area at relatively high voltage with substantial savings in cable. At the load center the voltage is stepped down to the required value and automatically maintained at that level. In addition to its use in lighting service, the unit can be employed to regulate the power supplied to resistance heating and infra-red heating equipment, electronic apparatus, precision instruments, and the electric circuit control. The unit is completely metal-enclosed and can be installed in any indoor location. 93



New four-in-one punch press placed on the market by Kenco Mfg. Co.

"Inductrol" power pack brought out by the General Electric Co.

To obtain additional information on equipment described here, use Inquiry Card on page 235.



Variable-speed electric power drive with mechanical remote control

Remote Control for Sterling "Speed-Trol"

An improved mechanical remote control for "Speed-Trol" variable-speed electric power drives has been announced by Sterling Electric Motors, Inc., Los Angeles, Calif. This control is so designed that it can be adapted to any "Speed-Trol" now in use. It is available with an extended flexible cable, as illustrated, or an extended rod with universal joint; right-angle bevel gear with extended rod; chain and sprocket; or a combination of any or all of these arrangements. A remotely located speed indicator with handwheel is also available with any of these mechanical control features.

The "Speed-Trol" electric power drives come in sizes from 1/2 H.P. to 25 H.P., inclusive, and are available with 2 to 1, 3 to 1, or 4 to 1 speed variations in a range of speeds from 2000 R.P.M. down to 26 R.P.M. 94

Air-Operated Zinc Die-Casting Machine

The ABC Die-Casting Machine Co., Chicago, Ill., has brought out an air-operated zinc die-casting machine designed primarily for economical high-speed production with single-cavity dies. Completely automatic cycling and adjustable timing dwell control for the opening and closing of the toggle mechanism and injection of the molten metal are operating features of the new machine. It will produce castings up to 1 pound in weight, using die-blocks 1 1/2 inches thick by 8 inches wide by 10 inches long, with an allowable increase in die thickness up to 3 inches for each half of die.

The machine is equipped with a molten metal pot of 200 pounds capacity, and is capable of a free cycling speed of over 1000 shots per hour. The rugged construction and powerful toggle mechanism of the machine are said to insure relatively flash-free castings. 95

Automatic-cycling, air-operated zinc die-casting machine brought out by ABC Die-Casting Machine Co.

Liquid blast cleaner made by the Pangborn Corporation

Pangborn Midget Unit for Liquid Blast Cleaning

A midget unit designed for liquid blast cleaning, which weighs only 40 pounds, has been added to the line of the Pangborn Corporation, Hagerstown, Md. This portable unit, known as the No. 0 Type EZ Hydro-Finish blast cabinet, can be operated from either a 1/4-inch compressed air line or any bottle of compressed gas. It has a blast chamber 15 inches in diameter, and its main housing is of aluminum.

This cleaning equipment is suitable for use in tool and die shops, heat-treating and electroplating departments, jewelry shops, garages, etc. It can be used to advantage for polishing dies, molds, and precision parts after heat-treatment; treating surfaces to better adapt them for holding

To obtain additional information on equipment described here, use Inquiry Card on page 235.

light lubricating oil films; preparing surfaces for plating; cleaning and maintaining tools and fixtures; cleaning parts that function at high temperatures, such as spark plugs; and removing stains and light scale.

The new unit uses the same wide range of abrasives (as fine as 5000 mesh) as the larger Pangborn units, and can hold tolerances on blasted parts to within 0.0001 inch. It requires a floor space of only 17 by 22 1/2 inches; stands on easily adjusted legs of 1/2-inch pipe; uses 110-volt alternating current to drive its filter and dust bag motor; consumes from 5 to 20 cubic feet per minute of air at 80 pounds per square inch (depending upon nozzle size); and is provided with a chamber light, right- and left-hand holes, a quick opening valve for knee or leg operation, and an observation window protected from splash and dirt by a cross-current of fresh inlet air.

The abrasive liquid mixture is contained in a clear glass bowl of 1/2 gallon capacity. Two sizes of suction type blast nozzles may be had, the air-stream and abrasive-stream port sizes being 1/16 inch and 1/8 inch, or 1/8 inch and 1/4 inch, respectively. 96

Pillow Blocks and Flanged Cartridges

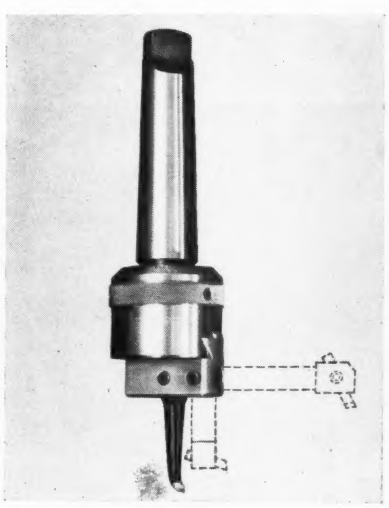
Boston Gear Works, Quincy, Mass., has brought out a new stock line of self-aligning, precision ball-bearing pillow blocks and flanged cartridges in shaft diameters of 1/2 inch to 1 1/4 inches.

A feature of these pillow blocks and flanged cartridges is a specially designed labyrinth seal, known as the "Safety-Vent-Seal," which automatically provides the correct amount of lubricant and permits excess grease to escape under pressure. The lubricant is sealed in, while dirt and dust are prevented from entering, and there is no danger of seals being blown out. 97

Pillow block of new line introduced by Boston Gear Works

Maxwell Improved Boring Tool

New "E-Z Set" boring tool designed to provide accuracy of setting to within 0.0002 inch and to speed up production work. Improvements include increased tool rigidity through incorporation of larger dovetail areas; ground-fit dovetail, micrometer-like adjustment to facilitate accurate settings; and elimination of distorting slots or gibs. Fabricated of chrome-nickel-molybdenum and nickel-molybdenum alloys. The change from steep-angle threads on the scroll mechanism to modified square type threads also serves to reduce backlash to a minimum and increase tool rigidity and accuracy. Available with maximum boring-bar capacities of 1/2, 1, and 1 1/2 inches, covering boring range of from 3/8 inch to 20 inches. Made by Maxwell Co., Bedford, Ohio.......98

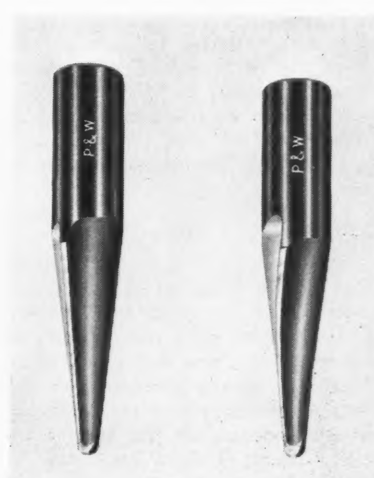


"Strobotac" Tachometer for Wide Speed Range

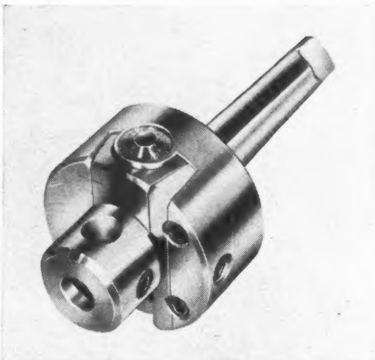
Stroboscopic tachometer, known as the "Strobotac," which measures a wide range of speeds without physical connection with the rotating equipment. The fundamental range of flashing speed is 600 to 14,400 times per minute. These speeds can be read directly from a dial calibrated in revolutions per minute. By using multiples of the flashing speed, the range of measurement can be extended to about 100,000 R.P.M. Speeds below 600 R.P.M. can be measured by multiple images. Accuracy is plus or minus 1 per cent of the dial reading above 900 R.P.M. when the "Strobotac" is standardized in terms of a frequency-controlled power line. Operates on 105 to 125 volts, 50 to 60 cycles. Made by Electronic Measurements Co., Red Bank, N. J.......99

P & W Taper Die-Sinking Cutters

Taper die-sinking cutters with full-cutting ball nose now being produced in two types by Pratt & Whitney Division Niles-Bement-Pond Co., West Hartford, Conn. These cutters are supplied with ball nose finish-ground to cut to dead center, so that no preliminary hand grinding is necessary. Two styles of fluting are available—straight for easy hand sharpening, and spiral for users who prefer helical cutting characteristics and have mechanical grinding equipment. These cutters have a 7-degree taper (14-degree included angle), and are regularly furnished with right-hand cut and straight shanks. The ball nose has a radius equal to one-half the diameter of the small end, and blends smoothly into the taper. Hardened by P&W "Diamond Blue" treatment...100

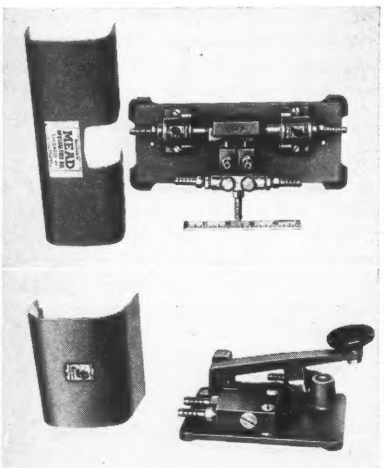


To obtain additional information on equipment described here, use Inquiry Card on page 235.



Flynn Offset Boring Heads

One of five offset boring heads added to line made by the Flynn Mfg. Co., Ferndale, Mich. The new heads will be identified as the "40 Series" and carry the model numbers 43, 45, 47, 48, and 49. They are of light weight design. The smallest (Model 43) has a 2 3/4-inch diameter and 1/2-inch bar capacity; it weighs 3 pounds. The largest (Model 49) has a 6 1/2-inch diameter and 1 1/2-inch bar capacity, with a weight of 24 pounds. Bar offset of the new series ranges from 5/8 inch to 1 1/2 inches. 101

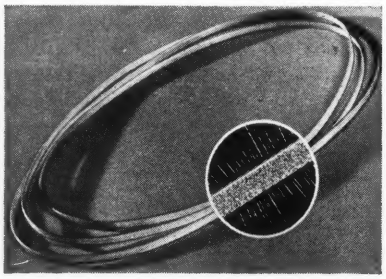


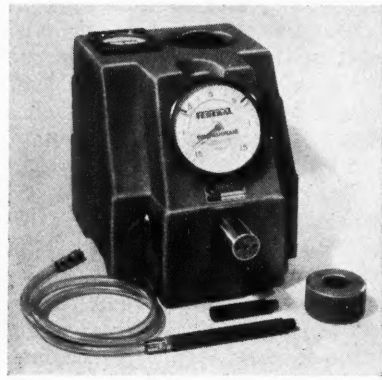
Pneumatic Timers

"Meadmatic" timers for use in controlling air to and from cylinders of pneumatic systems for drill press feeds and for the working and feeding strokes of other machine tools. The Model 4 timer, shown in the upper view, can be used as a remote reverse valve in combination with limit valves for obtaining automatic reversal of traversing or feeding movements. The Model 5 timer, shown in the lower view, is a simple pneumatic timing device that permits the operator to start the air-operated cycle of one machine and attend to the unloading or loading of another machine with the assurance that the timer will stop the machine at the end of the cycle. Products of Mead Specialties Co., Chicago, Ill. 102

Diamond Abrasive Belts

New diamond abrasive belt for use on carbide dies from 1/4 inch to 9 inches inside diameter. Made of solid nylon, impregnated with diamond abrasive in grades ranging from 1 to 5 microns up to a sieve or mesh size of 100. The resilience of the nylon provides a cushioning effect against shock, and prevents the diamond chips from tearing out of their sockets. These belts are not affected by humidity, and can be cleaned by washing in warm soap and water. They are impervious to oil, allowing the use of light oil as a coolant. The belts are made in five different colors, each color indicating the abrasive size. Available in lengths of 75 and 104 inches. Standard widths in the smaller size are 1/8, 3/16, and 3/8 inch, while the longer belts are made in widths of 3/16, 5/16, and 3/8 inch. Special lengths, widths, and grits can be furnished to specification. This new line of diamond abrasive belts is a product of Hartford Special Machinery Co., Hartford, Conn. 103





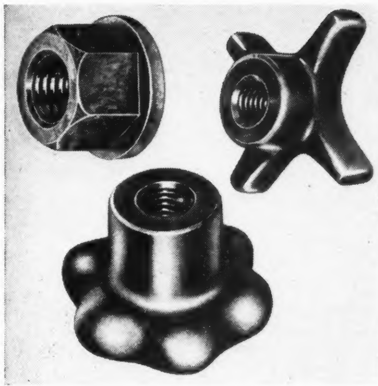
Federal Dimensional Air Gage

Dimensional air gage designated "Dimensionair," announced by Federal Products Corporation, Providence, R. I. This gage is said to have an exceptional measuring range and clearance, combined with practically perfect stability. The 0.003 inch measuring range enables the user to determine the size of a hole before reaching the ultimate size required. Irregular and tapered holes can also be gaged easily. Any air pressure between 40 and 100 pounds per square inch can be used. Normal fluctuations in pressure do not affect the accuracy. This air gage measures the dimension variation directly on a graduated scale. Each graduation represents 0.00005 inch, amplification being in the ratio of 2500 to 1. Tolerances are also read directly on the scale. Variations of five-millionths inch are easily determined. 104

Lester Adjustable Micrometers

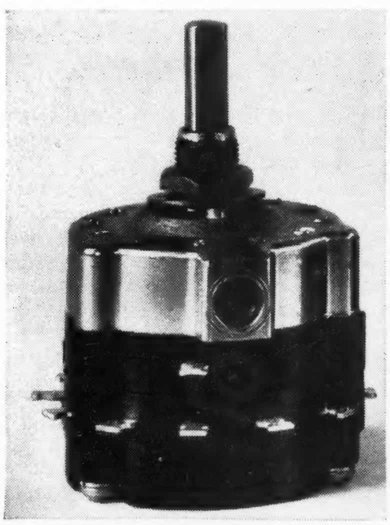
"V-Notch" adjustable micrometer designed to cover the range of twelve or twenty - four ordinary micrometers. Brought out by the Lester Micrometer Co., Cleveland, Ohio. This micrometer has a tool-steel blade with a series of twelve or twenty-four vee-shaped notches spaced exactly 1 inch apart. A carrier, sliding on the blade and holding a standard 1-inch micrometer head, can be quickly positioned in the desired notch and a spring clamp inserted to lock the carrier accurately to the blade. This setting is automatic and can be repeated with uniform accuracy. The 1-inch distance between notches is divided into 0.001-inch readings by the micrometer head. The spring clamp also acts as a safety mechanism to prevent the work or instrument from being damaged in case severe pressure is applied to the micrometer head. Various throat sizes can be supplied for measuring different diameters. 105

To obtain additional information on equipment described here, use Inquiry Card on page 235.



Hand-Knobs and Flanged Nuts for Jigs and Fixtures

Cast-iron hand-knobs and hardened flanged nuts of the designs illustrated have been added to the line manufactured by the Northwestern Tool & Engineering Co., Dayton, Ohio. The hand-knobs have a black penetrate finish, and are now being furnished in both star and hexagon types. They can be obtained plain, tapped, or reamed in sizes from 1/4 up to 3/4 inch inside diameter. The flanged nuts have a hardened finish, and are available in sizes from 5/16 inch up to and including 1 inch inside diameter. These nuts can be used to replace loose nuts and washers commonly used on jigs, fixtures, etc. 106

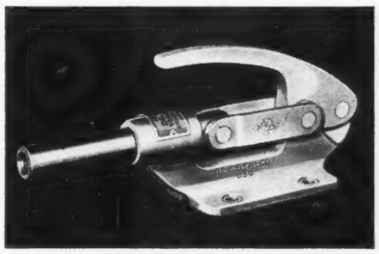


Leeds & Northrup Rotary Selector Switch

Rotary selector switch announced by Leeds & Northrup Co., Philadelphia, Pa. This switch is designed for use in instrument circuits, and is of totally enclosed construction. Contact resistance is about 0.001 ohm. Changes of less than 0.0005 ohm were shown on life tests of 10,000,000 operations. The stationary contacts are made of solid silver, and the brushes are of the multiple-leaf, self-aligning type made of silver alloy. The thermal electromotive force when switch is operated at normal speed is less than 1 micro-volt, making the switch suitable for low-level circuits. Contacts carry continuous current of 5 amperes. Adjustable detent permits variation of switching torque. Various switching combinations are supplied, from single-pole twelve-position to six-pole twelve-position. 107

"De-Sta-Co" Heavy-Duty Plunger Type Toggle Clamp

Powerful new heavy-duty plunger type toggle clamp added to the line of production work-holding tools made by the Detroit Stamping Co., Detroit, Mich.



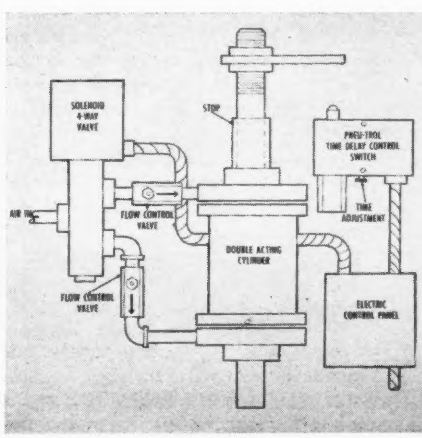
This clamp, known as "De-Sta-Co" No. 650, positions and holds work firmly in place with a toggle locking action said to deliver holding pressures up to 4000 pounds. The plunger has a travel of 3 inches and there is a 5/8-inch tapped hole in its end for an adjustment bolt. Self-feeding lubricator pad on top of plunger housing assures proper lubrication of plunger. The clamp is 3 inches wide, 4 1/2 inches high, and 11 1/4 inches long, and weighs 5 pounds 10 ounces. 108

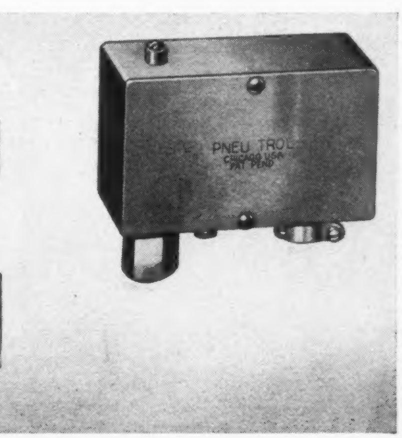
Delta-Milwaukee Coolant Pump and Tank Unit

Coolant pump and tank unit adaptable to a wide range of applications. Can be used on most machine tools for handling work that requires a coolant or cutting lubricant. It has sufficient capacity to meet the needs of multiple-spindle drill presses having up to eight spindles. The centrifugal type pump is secured directly to the 16-gallon tank by a flat machined flange, no piping being required between pump and tank. Several pump models are available, delivering from 6 to 32 gallons per minute. The 1/4-H.P. motor is fully enclosed to protect it from moisture and caustic solutions, and has ball bearings which are double sealed and lubricated for life. Motors of various electrical characteristics are available. A settling basin and wire-mesh screen keep the coolant free of chips. The nozzle is fully adjustable, so that the coolant can be made to hit the work at the proper angle. Supplied by Delta Power Tool Division, Rockwell Mfg. Co., Milwaukee, Wis. 109

Pneu-Trol Time-Delay Switch

Simple, positive, low-cost time-delay control switch for electric solenoid valve controls used with air or hydraulic cylinders, which permits time dwells from 1/4 second to 10 seconds. Small and compact in design, it can be mounted near the mechanical stop without interfering with the machine movement. The switch automatically resets itself after each actuation. Time-delay adjustments are easily made by turning a knurled screw. Used to control machine dwell for spinning, blanking, spot-facing, drilling, and tapping, as well as a wide variety of processing operations. Measures 3 7/8 by 2 3/8 by 1 3/8 inches. Developed by Pneu-Trol Devices, Inc., Chicago, Ill. 110





To obtain additional information on equipment described here, use Inquiry Card on page 235.

Sandblast Equipment for Cleaning Small Parts

Sandblast cabinet designed for cleaning dies, tools, pistons, piston-rings, valves, and other small parts. Supplied with two light fixtures for illuminating the interior, an exhaust fan, and a dust bag. Developed primarily to use soft abrasives, so that all surface impurities can be removed without scoring the metal. Can also be used with sand or metal abrasives if desired. Can be placed on a work-bench and connected to a compressed air line and to a 110-volt lighting circuit for operating the lights and the exhaust fan. Product of the W. W. Sly Mfg. Co., Cleveland, Ohio. 111

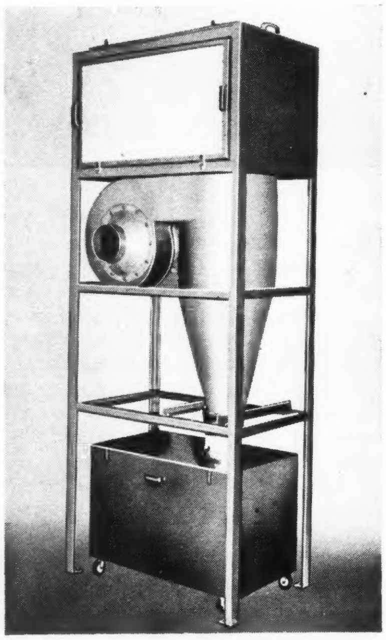
Rivett Hydraulic Unloading Valve

Hydraulic unloading valve recently added to the line of hydraulic devices made by Rivett Lathe & Grinder, Inc., Boston, Mass. This Model 8826 valve is used in oil hydraulic circuits to unload one part of circuit without back

pressure on the tank, the valve being operated by pilot pressure from some other part of the circuit. Free flow to the tank continues as long as the pilot pressure is higher than the pressure for which the valve is set. Available in sizes of 1/4 inch to 1 1/2 inches, and in two pressure ranges of 50 to 150 and 500 to 1500 pounds per square inch, adjustable from minimum to maximum in both ranges. 112

Dust Collector with "Roll-Away" Storage Bin

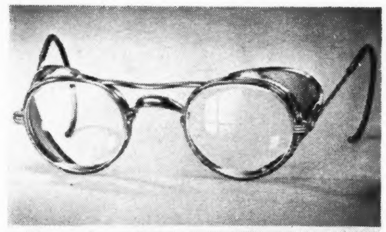
Self-contained "Dustkop" for dust-collecting involving large amounts of dust, chips, shavings, etc. This new Model 20B30 unit uses the basic elements of the standard model, including a 3-H.P. continuous-duty motor with direct drive

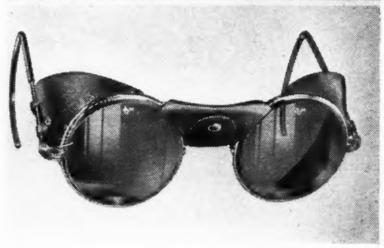


to paddle-wheel self-clearing fan; and a cyclone separator and second-stage fiber glass filter with shaker which permits the cleaned air to be recirculated within the working space. A caster-equipped "roll-away" bin of 9 cubic feet capacity is so arranged that it receives the bulk of the collected dust directly from the bottom of the cyclone separator. A quick acting connection at the lid of the bin allows easy detachment for emptying. Suction capacity is 2405 cubic feet per minute on a 7-inch inlet pipe Floor space required is 22 by 44 inches. Recently added to line of the Aget-Detroit Co., Ann Arbor, Mich..113

Improved Safety Goggles

Two improved design safety goggles announced by American Optical Co., Southbridge, Mass. The 7000 series metal safety goggles shown in the up-

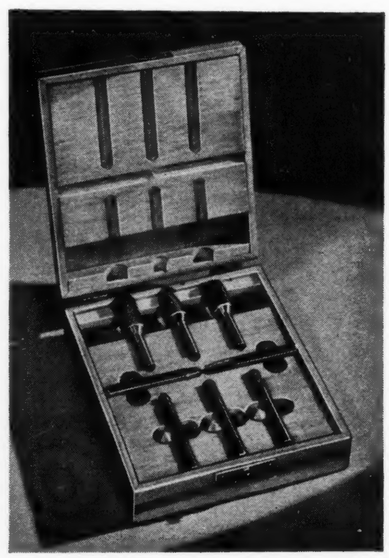




per view are designed to provide maximum eye protection with rugged construction, rigid saddle bridge, and reinforcing bar. Temples are protected by brown tubing which cannot discolor and will outlast the life of the temple. A new feature permits lenses to be replaced without removing side shields. The 3081 series shown in lower view has the same design features. In addition, the bridge and reinforcing bar are covered with a soft leather guard, and leather side shields provide protection against heat and cold, flying particles, and light. Both goggles can be obtained with clear or Calobar, regular or 6 curve Super Armorplate lenses.....114

Severance Carbide Diemaker's Tools

"Di-Car" set No. 40 consisting of eight 1/4-inch shank carbide rotary finishing tools specifically designed for toolmaker's and diemaker's use. The various cuts, tooth patterns, and shapes of these tools have been selected to cover the greatest possible range of usefulness, and work equally well on soft or hardened dies. They are furnished, as shown, in a wooden case designed to

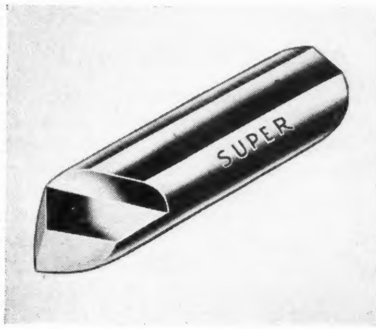


To obtain additional information on equipment described here, use Inquiry Card on page 235.

serve as a convenient chest for the tools. This equipment is manufactured by Severance Tool Industries, Inc., Saginaw, Mich. 115

Solid Carbide Boring Tool

Solid carbide boring tool recently added to line of Super Tool Co., Detroit, Mich. This line now includes a total of nine types of carbide boring tools. These

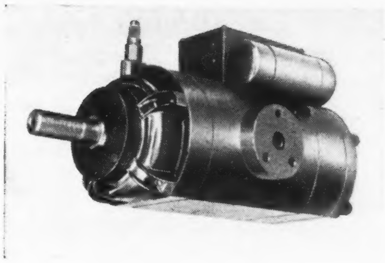


tools are available from stock in a wide range of carbide grades. There is a standard type designed especially to fit each of the more popular makes of boring machines. 116

"Emdco" Hot-Cold Test Stand

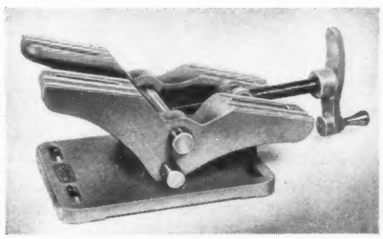
Recent addition to the line of testing equipment built by Electro Mechanical Devices, Division of George L. Nankervis Co., Detroit, Mich. This test stand is

designed to produce any temperature between minus 70 degrees F. and plus 230 degrees F. for determining operating characteristics of sub-assemblies within this temperature range. Can be used to test airplane units at temperatures equivalent to those encountered in actual flight conditions. Will accommodate parts up to 6 by 6 by 8 inches in size. The complete test stand measures only 30 inches wide by 40 inches long by 54 inches high. 117



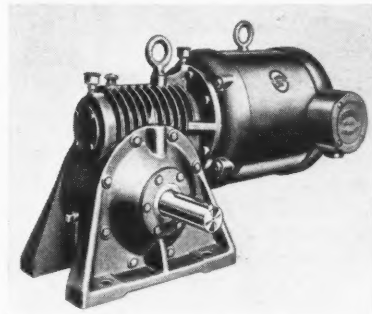
DeWalt "Lo-Dead Rise" Direct-Drive Motor

"Lo-Dead-Rise" direct-drive motor with mounting base at a minimum distance below the spindle. This feature permits fuller utilization of the cutting depth capacity of circular saw blades or disks. The motor is totally enclosed and fan-cooled. It has end brackets, end rings, and fan and fan housing pressure-cast for greater strength. Fiberglas insulation is used for phase insulation. Announced by DeWalt, Inc., Lancaster, Pa. 118



Tilting Motor Base for Small Motors

Light-weight tilting base which is adjustable in width and length to accommodate all sizes and types of fractional-horsepower motors. Adapted for use with variable-speed pulleys; as a belt tightener; and for easy belt changing on cone pulleys. Speed changes can be made while machine is in operation. With this equipment, correct belt tension and alignment are always maintained. Speed control is obtained by simply turning handle of screw adjustment. Measures 5 1/2 by 7 inches. Product of Lovejoy Flexible Coupling Co., Chicago, Ill. 119

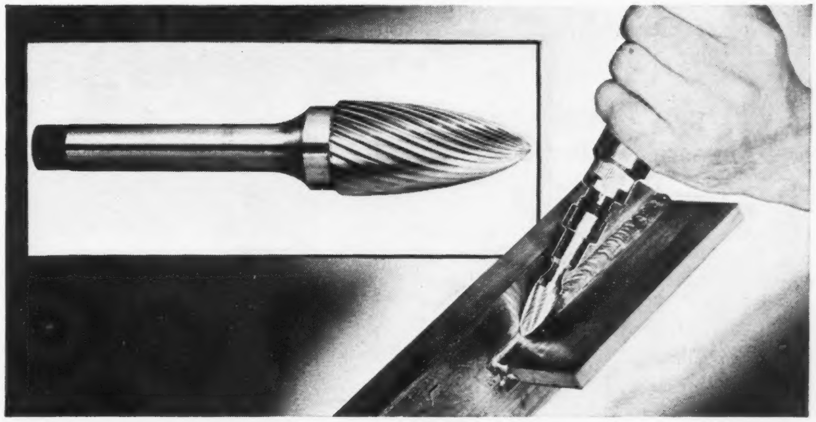


Janette Ventilated Gear-Motors

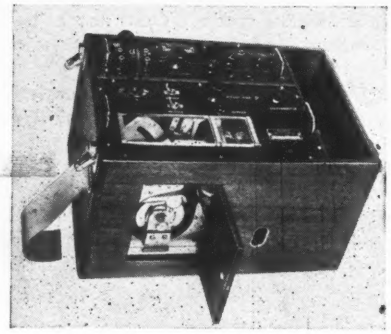
One of a new line of ventilated integral type gear-motors brought out by the Janette Mfg. Co., Chicago, Ill. With the new addition, the Janette line includes ventilated, enclosed, and totally enclosed fan-cooled types of gear-motors. The single-phase motors are available in 1 H.P. and smaller ratings; polyphase and direct-current motors are obtainable in ratings through 7 1/2 H.P. Six types and sixteen sizes of gear-boxes furnished with motors include gear combinations for either single or double reduction and for either worm-gears or combination worm and planetary gears. Designed for maximum mounting flexibility. 120

Rotary Carbide Tool for Finishing Stainless Steel Welds

Rotary carbide tool designed for rapid, economical finishing of stainless-steel welds. The flute design of this tool is said to make possible the finishing of stainless-steel parts in half the time formerly required, and with an increase in tool life of from 400 to 800 per cent. The method of using this tool is shown in view below. Made by M. A. Ford Co., Inc., Davenport, Iowa. 121

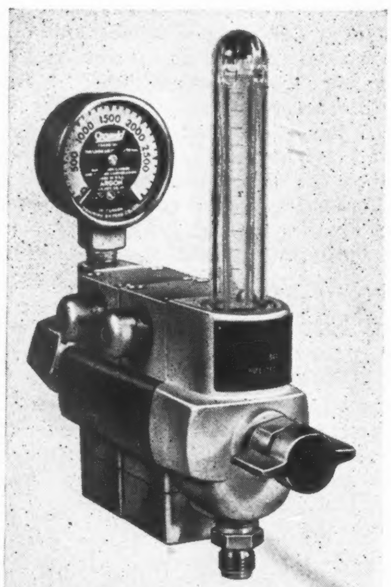


To obtain additional information on equipment described here, use Inquiry Card on page 235.



High-Speed Inkless Strain Recorder

New Baldwin-Sanborn recording SR-4 strain amplifier which reproduces both static and rapidly changing SR-4 gage measurements of strains, forces, fluid pressures, displacements, vibrations, acceleration, etc., on a strip chart with rectangular coordinates. Announced by Baldwin Locomotive Works, Philadelphia, Pa. This instrument is of the direct writing, inkless, vacuum-tube voltmeter type consisting of an alternating-current strain gage amplifier of the modulated carrier type in which the bridge is excited at 2500 cycles per second by a built-in oscillator; a moving coil recording galvanometer; and a paper drive mechanism. 122

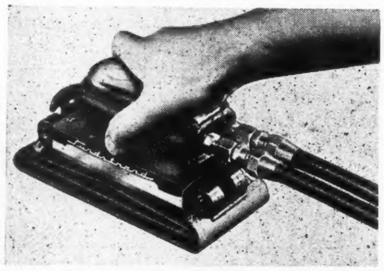


Argon Regulator-Flowmeter for Arc Welding

Direct-reading combination regulator and flowmeter for the measurement of argon flow, announced by The Linde Air Products Company, Unit of Union Carbide and Carbon Corporation, New York, N. Y. This R-502 regulator-flowmeter is designed for use with "Heliarc" welding, argon metal arc welding (described in the June, 1950, issue of MACHINERY), and other related processes. The three-stage type regulator maintains a constant inlet pressure of 20 pounds per square inch, and the flowmeter permits steady flow rates up to 60 cubic feet per hour. 123

Sundstrand Single-Pad Air Sander

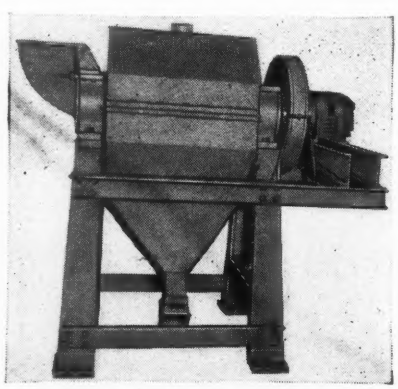
Straight-line action, single-pad air sander announced by Pneumatic Division of Sundstrand Machine Tool Co., Rockford, Ill. This sander is especially

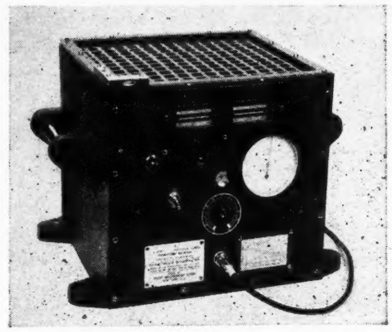


adapted for use in auto-body refinishing shops. Due to its straight-line action, this sander leaves no swirls and no pressure marks, a feature of primary importance in all work where an extra-smooth surface is desired. Operates either wet or dry, and is suitable for use on a wide variety of work. 124

Peerless Dry-Process Metal Separator

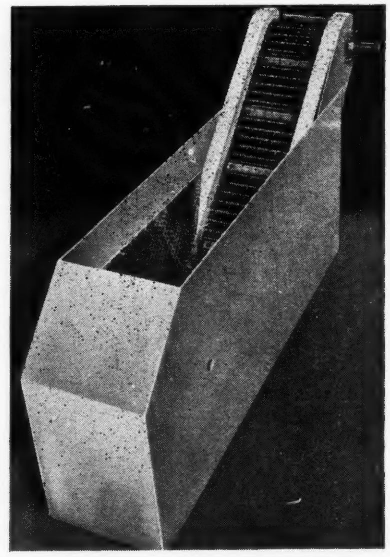
Improved dry-process metal separator for use in extracting good metal from skimmings, slag, sweepings, etc., in hot-dip galvanizing and die works, foundries, smelting plants, or wherever non-ferrous metals are melted and cast. Recovers such metals as brass, bronze, aluminum, zinc, lead, die-cast metal, babbitt, magnesium, etc., making them available for immediate resmelting. The separator needs no heat or water, operates automatically, has low maintenance costs and does not require a skilled operator. Available from Peerless Metal Separator Co., New York City. 125





Avion "Magnetorque"

Dynamometer for measuring torque developed by prime movers of from 1/2 to 10 H.P. Compactness, portability, and large power ratio are obtained by the use of a magnetic-particle coupling. The instrument has a wide range of applications, including motors, gear trains, and other rotating devices. It will dissipate 4 H.P. continuously at 3600 R.P.M. and measure torque equivalent to 10 H.P. at 4800 R.P.M. if the duty cycle maintains the operating temperature below 220 degrees C. Additional loading may be handled if external cooling is provided. The instrument is mounted in a metal cabinet 11 by 11 by 12 inches in size. It weighs 130 pounds. Announced by Avion Instrument Corporation, New York City. 126



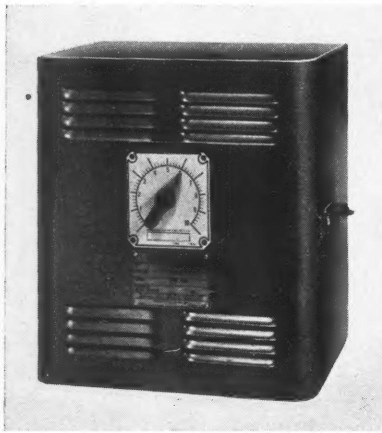
Quenching and Conveying Unit for Metal Parts

Quenching and conveying equipment designed for continuous heat-treating of individual pieces. The oil in the tank is recirculated and cooled while the metal belt allows the quenched parts to drain as they move up the inclined conveyor, driven by a self-contained power unit. Cleats or flights can be attached to conveyor. Unit is 8 feet long, 2 feet wide, and 4 feet high. Manufactured by Klaas Machine & Mfg. Co., Cleveland, Ohio. 127

To obtain additional information on equipment described here, use Inquiry Card on page 235.

Westinghouse Low-Capacity Spot-Welding Control Equipment

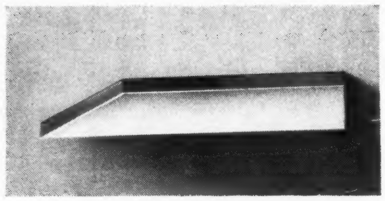
New synchronous and non-synchronous control equipment for low-capacity, spot type resistance welding machines, available from Westinghouse Electric Corporation, Pittsburgh, Pa. Air-cooled thyratron tubes make and break the



welding current with no moving parts. All components in each unit are mounted on a side-swinging panel. The units can be mounted on or near the welding machine. Knock-outs are provided in the enclosure to facilitate making external electrical connections. Synchronous units can be supplied in r.m.s. current ratings up to 50 amperes at a 10 per cent duty cycle. Non-synchronous units are available in ratings up to 100 amperes at 10 per cent duty cycle. 128

Starrett Tungsten-Carbide Scriber

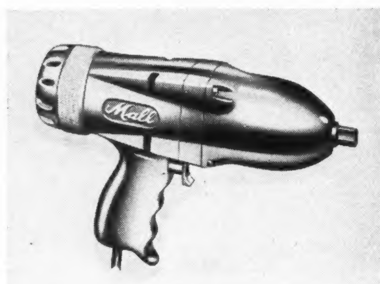
Tungsten-carbide scriber brought out by L. S. Starrett Co., Athol, Mass., for use with its vernier height gages. This No. 454X scriber can be used to ad-



vantage when lay-out lines are to be scribed on very hard materials, such as hardened steel, glass, etc. Available in two sizes for 10-, 18-, and 24-inch No. 454 vernier height gages. Interchangeable with the standard scribers on these gages. 129

Mall Impact Wrench

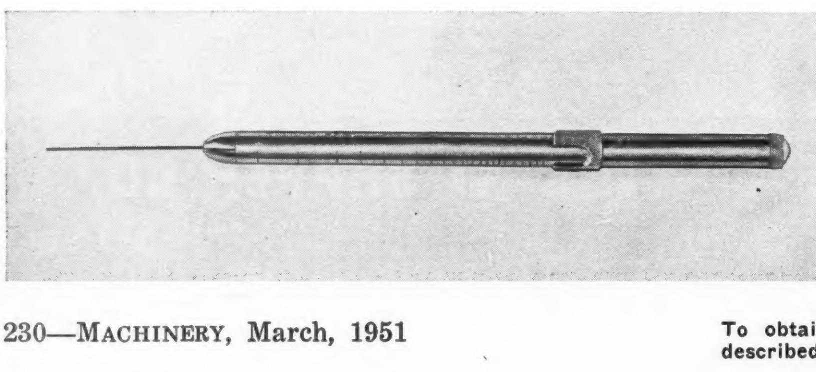
Portable electric impact wrench designed to apply and remove screws, studs, and nuts up to the 1/2-inch bolt size. Will also drill, tap, ream, and extract broken cap-screws or studs, as well as drive wood augers, hole saws, and wire brushes. Designed for one-hand operation on automotive work, steel construction, and general industrial jobs. This 11-inch, 7-pound, Model 2EW unit has



a new pistol grip and trigger switch designed to provide better control and instant response. The air-cooled, universal motor operates on 115-volt alternating or direct current. Placed on the market by the Mall Tool Co., Chicago, Ill. 130

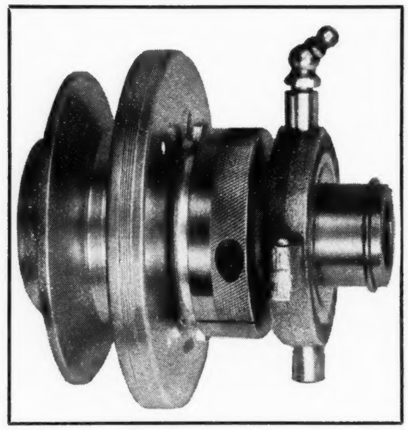
Pencil-Shaped Vest-Pocket Tachometer

Fowler "Vibra-Tak" vest-pocket instrument for accurately checking the revolutions per minute of any rotating machine. It is only necessary to place the nose of the "Vibra-Tak" in contact with any part of the machinery, adjust the sliding collar to obtain the maximum swing of the reed, and then read the revolutions per minute directly on the body of the instrument. This tachometer indicates speeds of equipment having members which rotate at speeds up to 15,000 R.P.M. Introduced by Verdell Instrument Sales Co., Burbank, Calif. 131



Edgemont Disk Type Clutch

One of a new series of disk type friction clutches for stub- or through-shaft mounting, suitable for use on gasoline or electric motors, speed reducers, and auxiliary shafts. The basic model of the new Type K clutches includes a V-belt pulley. It is available with one- or two-groove pulleys in sizes of 3 3/8 or



3 3/4 inches outside diameter. The Type K-S clutch is furnished for use with plate type sprocket when only short idling periods are required. The Type K-E clutch has split friction disks, and is built in two styles—a cut-off coupling for connecting two aligned shafts, and an extended sleeve coupling type for mounting pulleys, sprockets, and gears in through-shaft applications. Announced by the Edgemont Machine Co., Dayton, Ohio. 132

Air Vibrators

Air vibrator available in eight standard sizes to meet a wide range of applications. Can be furnished with long-stroke or standard-stroke piston to assure the correct intensity of transmitted power. Designed for operation on standard 80-pound per square inch line pressure. Available in 2- and 2 1/2-inch piston diameters. Announced by Spo, Incorporated, Cleveland, Ohio. 133

To obtain additional information on equipment described here, use Inquiry Card on page 235.

BETWEEN GRINDS

By E. S. Salichs

We are Taken by Surprise

January MACHINERY presented a list of articles pertaining to manufacturing information on ordnance, aircraft, and shipbuilding published in the magazine during World War II. We had suggested in unobtrusive small type that photostats could be supplied at nominal cost upon request. When letters poured in, not for two or three articles mind you, but for fifty, seventy-five, and up, we were confessedly set back on our heels—but jack-knifed into action and by putting Jones' work on Smith's desk, filled orders right and left. We are now a-settin in our rocking chair a-rockin with the knowledge of a duty well performed—what's that batch of letters yonder on the desk covered by last week's dust?

Send Out Supplement

From Inchon, Korea, we received a letter from Navy boys F. Hansen and Walter Misch: "There are two of us aboard this ship (LSD) operating the machine shop, in connection with the repair and maintenance of small craft and general upkeep of the ship. Since we are operating various types of equipment daily, we find that MACHINERY'S HANDBOOK is the best reference we have yet to find." The letter was apropos of our "Use of Handbook Tables and Formulas" which they needed.

Punctured!

In January we reported with round - eyed admiration that Goodrich was rolling tires on a special government assignment within 2/1000 of an inch of being absolutely symmetrical. But Mr. H. Landauer, a Floridian machinist, now tells us it's no trick: "All you do is to fully inflate the tire, let it rotate on its own axle and bearings, by holding the axle between centers or on a steadyrest and grind the O.D. with a $50 toolpost grinder, possibly to a simple templet the shape of the tire cross-section. However, if you want the tire perfect even in the deflated condition (but nobody wants that, because you can always regrind it after re-inflation), you force the tire on an aluminum ring with the shape of the tire's inside contour while grinding." And then he shattered us by ending his letter, "Between Grinds indeed." Were we now to hear of a square tire we simply wouldn't breathe a word about it until we had first consulted Mr. Landauer—indeed.

Enmeshed

A discussion by mail over a formula appearing in MACHINERY'S HANDBOOK resulted in the receipt of a sample of a planetary gear train built by the doubting correspondent to prove his point. Our associate book editor, convinced of the correctness of the formula, then used the man's own model to point out the error. "You are right" was the rejoinder.

So Right

The little "Dictionary of Machine Shop Terms" defining *mushroom head* adds: "A condition to be avoided."

TO PERFORM AND POSTFORM—Plastics expert William I. Beach was born in Marceline, Mo., and upon completing high school served in the U. S. Navy for four years, from 1922 to 1926. Having seen the world, he established his beach-head on the Pacific Coast. Then he matriculated at the University of Washington, receiving a degree in aeronautical engineering in 1938. A year later he joined North American Aviation, Inc., Los Angeles, as wing stress analyst, and became chief plastics engineer for the company in 1942. Took time out for two years as a private plastics consultant, returning to North

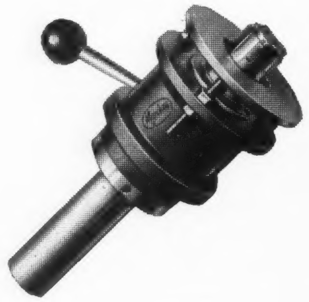
American in 1947. In addition to general patent work, he specializes in the company's licensing programs relative to new devices and processes, and in general plastics engineering. In 1945, Mr. Beach received the John Wesley Hyatt Award for making the highest contribution to the plastic industry, based upon his development of the Postforming process. The second of a series of articles Mr. Beach is writing for MACHINERY on Postforming laminated plastics appears in this issue, page 170. He is married and at the Beach cabana there are two youngsters anxious to try out their non-plastic wings.

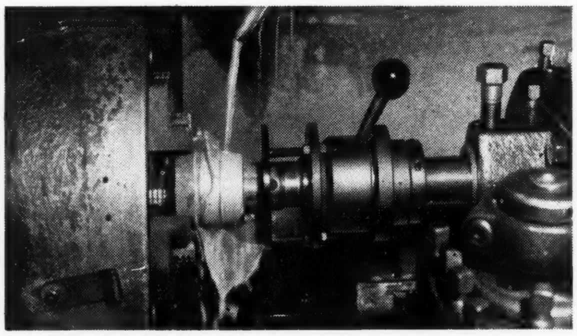
MURCHEY REPRESENTATIVES

ATLANTA
C. W. Moore
BOSTON
General Machinery Corp.
BUFFALO
Erwin Slate (Gasport)
CHICAGO
R. E. Ellis Engineering Co.
CLEVELAND
Production Tool Co.
DALLAS
Engineering Sales Co.
DAVENPORT
R. A. Broerman
DAYTON
Woodall Engineering & Sales Co.
DENVER
Iver J. Esbenson
DETROIT
Murchey Division
The Sheffield Corp.
ERIE
Walter J. Greenleaf
HARTFORD
W. H. Gourlie Co.
HOUSTON
Engineering Sales Co.
KANSAS CITY
Glade Ives
LANSING, MICHIGAN
A. D. Schneider & Co.
LOS ANGELES
Ofeld Industrial Sales &
Engr. Co. (Compton)
MEMPHIS
Watt Machinery Co.
MILWAUKEE
John L. McCoy
MINNEAPOLIS
John L. McCoy (Milwaukee)
MONTREAL
A. C. Wickman Limited
MUNCIE
Louis E. Nelson
NEW YORK
Frank W. Blanchette (Newark)
PHILADELPHIA
P. A. Patterson Co., Inc.
PITTSBURGH
Walter J. Greenleaf Co.
ST. LOUIS
Louis A. Hoppe
SALT LAKE CITY
Iver J. Esbenson (Denver)
SEATTLE
Dawson Machinery Co.
SYRACUSE
Axel Olson
TOLEDO
W. W. Pound
TORONTO
A. C. Wickman Limited
WINDSOR, ONT.
A. C. Wickman Limited

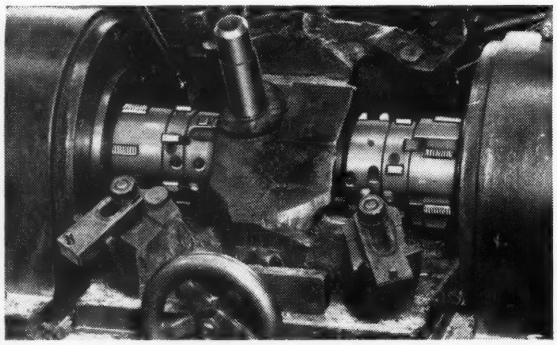
LOWER COST PER THREAD *AND BETTER THREADS* WITH MURCHEY TOOLS

- Collapsible Machine and Pipe Taps
- Solid Adjustable Taps
- Radial Chaser Die Heads
- Tangent Chaser Die Heads





Standard Directly from Stock
OR Special For Combined Operations



Call your nearest Murchey representative who will gladly assist you as required on any threading job

Manufacturers of collapsible taps, self-opening die heads (tangent and radial chaser types) and special threading tools

MURCHEY DIVISION
OF THE
MURCHEY
SHEFFIELD CORPORATION
DAYTON 1, OHIO, U.S.A.

News OF THE INDUSTRY

California and Texas

BELLOWS CO., Akron, Ohio, manufacturer of "controlled-air-power" devices, has established West Coast regional headquarters at 733 E. Pico Blvd., Los Angeles, Calif. GEORGE COOK, formerly of Conapco, Inc., will act as West Coast regional manager.

RICHARD T. BARNES has been named West Coast representative of Tumb-L-Matic, Inc., Bronx, N. Y., manufacturer of tumbling machines. He will be located at San Francisco, Calif., with mailing address P.O. Box 227.

W. P. L'HOMMEDIEU has been appointed assistant Pacific Coast district manager for the Westinghouse Electric Corporation, with headquarters in San Francisco, Calif.

CLECO DIVISION OF THE REED ROLLER BIT CO., Houston, Tex., has appointed MONTES Y VALLES, S.A., Vallarta 1, 305B, Mexico 4, D.F., distributor of Cleco pneumatic tools.

Connecticut and Massachusetts

H. EDWARD NEALE has been made assistant sales manager of the Bullard Co., Bridgeport, Conn., manufacturer of machine tools. Mr. Neale became associated with the company in 1935 as a student engineer. In 1947, he was made representative of the company for New York State. Prior to his present appointment, he was representative in the Chicago territory. In his new capacity, he will be located at the home office in Bridgeport. JAMES L. SHAY succeeds Mr. Neale as representative in the Chicago area, with headquarters at the offices of Marshall & Huschart Machinery Co., 571 Washington Blvd., Chicago, Ill.

H. Edward Neale, assistant sales manager of the Bullard Co.

MOORE SPECIAL TOOL CO., INC., Bridgeport, Conn., has recently increased by 25 per cent its facilities for manufacturing precision machine tools. An extension of the main plant has been constructed which adds 15,000 square feet of floor space, and $100,000 worth of new machine tools have been installed.

GEORGE T. FRASER has been appointed manager of sales for Rem-Cru Titanium, Inc., Bridgeport, Conn. He was formerly assistant manager of tool steel sales of the Crucible Steel Co. of America at Syracuse, N. Y.

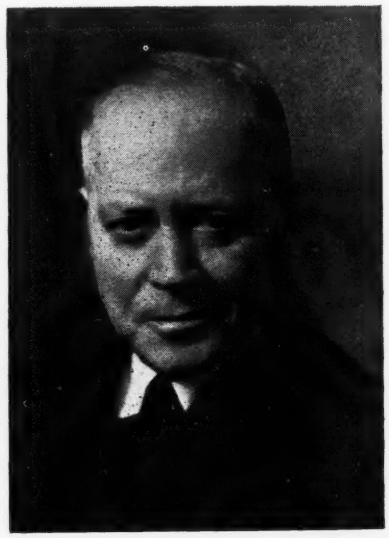
NORTON CO., Worcester, Mass., recently opened a new electric furnace plant for the manufacture of silicon carbide abrasive at Cap-de-la-Madeleine, Quebec, Canada. The new plant will provide facilities for a 50 per cent increase in the manufacture of Crystolon abrasive.

C. B. HOUSE, JR., and LEE J. MOHLER have been appointed sales managers, respectively, of the alternating-current motor section and the direct-current motor and generator section of the Lynn, Mass., Motor Sales Division of the General Electric Co.

Illinois

O. STANLEY SWANDAHL has been made district manager for Lake County, Ill., and various sections of Wisconsin by DeWalt, Inc., Lancaster, Pa., manufacturer of a line of cutting machines for metal, wood, and plastics.

ROBERT C. ROSS has retired from active service with Joseph T. Ryerson & Son, Inc., Chicago, Ill., after forty-seven years with the company. He was vice-president in charge of operations for many years, and for the last two years has served in an advisory capacity in connection with the Ryerson construction program. Starting as a telegraph operator in 1903, he rose to the position of assistant to the president in 1929, and two years later was elected a director and vice-president in charge of plant operations.



Robert C. Ross, who has retired as vice-president of Joseph T. Ryerson & Son after forty-seven years with the company

INDEPENDENT PNEUMATIC TOOL CO., Aurora, Ill., manufacturer of Thor portable power tools, announces the purchase of ARMSTRONG-WHITWORTH & CO., PNEUMATIC TOOLS, LTD., Gateshead-on-Tyne, England, one of the largest manufacturers of pneumatic tools in that country. The English concern now becomes an affiliate of Independent Pneumatic Tool Co., Ltd., London, England, a subsidiary of the parent company in America. ROBERT G. FAVERTY, former manager of Thor branches in Chicago and Detroit, has been appointed managing director of the newly acquired business. The Armstrong-Whitworth name will be retained under the new ownership.

BARRETT-CRAVENS CO., Chicago, Ill., announces that a merger has been effected with the CRESCENT TRUCK CO., of Lebanon, Pa., manufacturer of electric industrial trucks and trac-


JOB
PROVED

tors. The latter company will be operated as a division of the Barrett-Cravens Co. Engineering and manufacturing operations will be continued at Lebanon with the same personnel, but all sales will be handled from Chicago.

ARTHUR T. DALTON, secretary of the Chicago Wheel & Mfg. Co., Chicago, Ill., has been appointed a member of the Advisory Committee of the Abrasive Industry, National Production Authority, Washington, D. C. Mr. Dalton has been connected with the Chicago Wheel & Mfg. Co. for twenty-six years.

ANDREW K. KOLAR, district manager for the Link-Belt Co. at Moline, Ill., has been appointed assistant sales manager of the Pershing Road plant, with office at 300 W. Pershing Road, Chicago, Ill. STUART T. PENICK, district engineer at Dallas, Tex., has been transferred to Moline to succeed Mr. Kolar.

DR. MAURICE NELLES has joined the Borg-Warner Corporation, Chicago, Ill., in the capacity of director of the Engineering Development Section. Dr. Nelles was formerly director of the Engineering Experimental Station of the Pennsylvania State College and professor of engineering research at that college.

THUR SCHMIDT has been appointed assistant to the president of the Ingersoll Products Division, Borg-Warner Corporation, Chicago, Ill. He was previously general manager of the Highway Steel Products Co., Chicago Heights, Ill. Mr. Schmidt will handle product development.

HAROLD G. INGERSOLL has been elected vice-president of the Borg-Warner Corporation, Chicago, Ill. In addition to filling his new duties, he will retain his present position as president of the Ingersoll Steel Division at New Castle, Ind.

DOW CHEMICAL CO., Midland, Mich., has purchased the former Standard Steel Spring plant at Madison, Ill., which will be utilized for rolling and extruding magnesium for defense purposes. Installation will include the first modern continuous rolling mill for magnesium. R. E. MCNULTY, production manager of the Magnesium Division, will be manager of the new plant.

E. L. ESSLEY MACHINERY CO., Chicago, Ill., has recently been awarded the sales representation of the complete line of machine tools made by the VAN NORMAN CO. of Springfield, Mass. The territory covered by the Essley organization will include Illinois, Wisconsin, Iowa, western Michigan, eastern Nebraska, and northern Indiana.

JOSEPH T. RYERSON & SON, INC., Chicago, Ill., has been appointed exclusive warehouse distributor of Rockrite tubing, manufactured by the TUBE REDUCING CORPORATION, Wallington, N. J.

CHARLES F. ALEXANDER has been named manager of the Industrial Department of the National Safety Council, 425 N. Michigan Ave., Chicago 11, Ill.

Maryland and District of Columbia

VICTOR F. STINE and LLOYD L. STOUFFER have been elected directors of the Pangborn Corporation, Hagerstown, Md., manufacturer of blast cleaning and dust control equipment. Mr. Stine also assumed on January 1 the duties of vice-president in charge of sales and engineering, while Mr. Stouffer became secretary and treasurer and will have charge of production. Executive vice-president P. J. POTTER is retiring from active duty, but will continue to serve as a director and vice-president, and will act in a consulting capacity.

BLACK & DECKER MFG. CO., Towson, Md., has recently purchased approximately 180 acres at Hampstead, Md., on which will be erected a branch plant to provide additional facilities for the manufacture of portable electric tools. The new factory will be entirely distinct from the Towson plant, which will continue in full operation.

MARSHALL M. SMITH, former president of the E. W. Bliss Co., Canton, Ohio, has been appointed director of the National Production Authority's Machinery Division. In 1949, Mr. Smith relinquished his office as president of the E. W. Bliss Co. for reasons of health and took over foreign operations and sales for the company. He was granted a leave of absence from this job to take up his new assignment. Named as assistant to Mr. Smith in the Machinery Division are HERBERT L. TIGGES, executive vice-president and sales manager of Baker Brothers, Inc., Toledo, Ohio, and P. L. HOUSER of the National Harvester Co., Chicago, Ill., who will serve as acting chief of the Machine Tool Section.

Harold G. Ingersoll, recently elected vice-president of the Borg-Warner Corporation

Victor F. Stine, vice-president in charge of sales and engineering of Pangborn Corporation

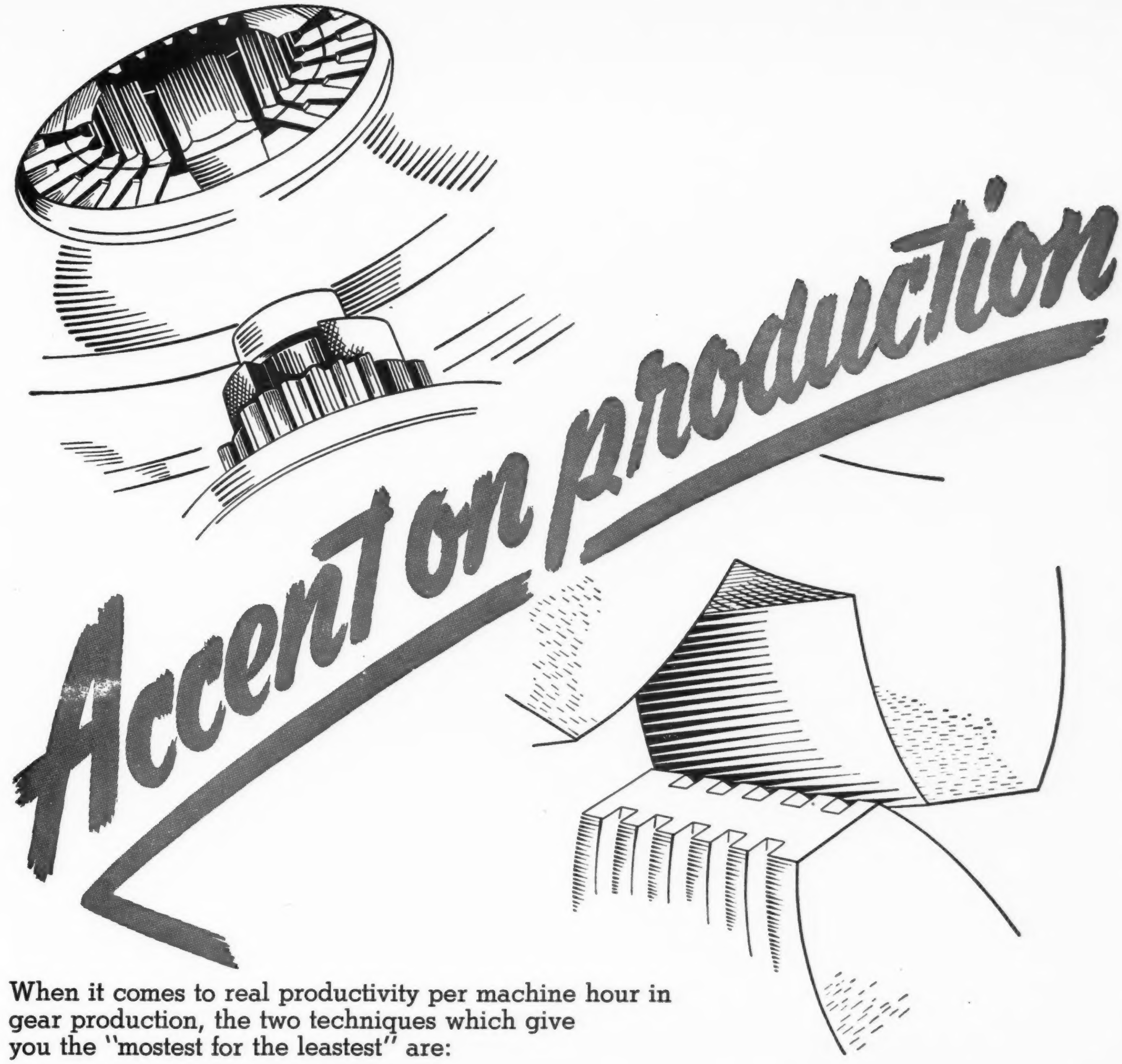
Michigan

ARNOLD LENZ, for thirty-four years connected with the General Motors Corporation, has been named general manager of the Pontiac Motor Division, Pontiac, Mich. Prior to his present appointment, he was executive assistant to former general manager HARRY J. KLINGLER, who is now in charge of all General Motors passenger car and truck divisions.

HANNA ENGINEERING WORKS, Chicago, Ill., has appointed the INDUSTRIAL AIR & HYDRAULIC EQUIPMENT CO., 13306 Kercheval Ave., Detroit, Mich., exclusive sales representative of Hanna air and hydraulic cylinders and controls in the state of Michigan east of Lake Michigan.

RAY MORRISSEY has been made manager of manufacturing engineering, Engine and Foundry Division of the Ford Motor Co., Detroit, Mich. He was formerly on special assignment in the production manager's office, Automotive Manufacturing Operations.

BERNARD W. POLAND has been appointed field representative covering



When it comes to real productivity per machine hour in gear production, the two techniques which give you the "mostest for the leastest" are:

1 Shear-Speed gear cutting. In which all teeth are cut simultaneously in a fraction of the time required by other cutting methods. Applicable to internal and external spur gears and splines (involute and other shapes)—also to other toothed-form parts, regular or irregular. (Some helicals, also, but not all.)

2 Underpass gear-finishing in which a single "pass" of the cutter forward and back finishes a gear to the highest precision. (For very wide gears, traverpass or transverse shaving can be used on the SAME MACHINE—if it's a "Michigan".) Underpass shaving is available for spur and helical gears and splines from ¼ in. to many feet in diameter.

To produce more gears per hour "for less"—in mass production or job lots—you can't beat a "Michigan-tooled" line.

COMPLETE from blank to finished gear EQUIPMENT

MICHIGAN TOOL COMPANY **7171 E. McNichols Road Detroit 12, U.S.A.**

the states of Michigan, Wisconsin, Minnesota, Iowa, Nebraska, and the Dakotas for the Physicists Research Co., Ann Arbor, Mich., manufacturer of surface-measurement instruments.

HERBERT L. SCHULTZ has been named plant manager of the Mid-West Abrasive Co.'s new plant at Owosso, Mich. He has been in charge of the lay-out and engineering for this plant.

MOLD-A-MATIC Co. announces its removal to new and larger quarters at 1731 E. Eleven Mile (near Dequindre) Royal Oak, Mich. The mailing address is Box 286-T, R.R. 4.

R. J. FORESMAN, who was recently elected assistant secretary of the Mid-West Abrasive Co., Owosso, Mich., has also been appointed assistant general sales manager.

DOMENIC A. DITIRRO has been named head of the Sales and Technical Service Engineering Divisions of the Ross Operating Valve Co., Detroit, Mich.

New Jersey

S. G. FRANTZ CO., INC., formerly of New York City, manufacturer of magnetic separators, has transferred its sales and manufacturing facilities to a new plant on the outskirts of Trenton, N. J.

JAMES R. HITT has been appointed manager of the factory branch of the Trailmobile Co., Newark, N. J., manufacturer of truck-trailers.

New York

ELLIOTT HARRINGTON has been appointed vice-chairman and secretary of a newly established Defense Projects and Priority Committee of the Small and Medium Motor Divisions of the General Electric Co., Schenectady, N. Y. His former duties as manager of the Induction Motor Sales Division have been assumed by R. S. WALSH, previously assistant manager of that division. Other appointments announced are D. S. MACDONALD, sales manager of the newly created Gear Motor Section of the Gear Motor and Packaged Drive Division; FRANCIS J. BOUCHER, manager of manufacturing of the Small and Medium Motor Divisions; and JOHN W. BELANGER and NICHOLAS M. DUCHEMIN general managers of the Large Apparatus Divisions and Small Apparatus Divisions, respectively.

HAUSER MACHINE TOOL CORPORATION, Manhasset, N. Y., announces the formation of an affiliated company known as the CARL HIRSCHMANN Co. Both companies will share the same offices and show-rooms at 30 Park Ave. in Manhasset. The Carl Hirschmann Co. will be exclusive U. S. agent for a number of Swiss precision tool manufacturers, including TORNOS WORKS, LTD.; SCHAUBLIN, S.A.; LAMBERT, S.A.; SAFAG, S.A., and AGATHON LTD. The Hauser Machine Tool Corporation is agent for Henri Hauser, Ltd., of Switzerland.

RAYMOND D. MACDONALD has been named sales representative of J. H. Williams & Co., Buffalo, N. Y., manufacturer of drop-forgings and drop-forged hand tools. He will represent the company in western and central New York State, northern Pennsylvania, and adjacent Canada, making his headquarters at the home office in Buffalo.

BLACK & DECKER MFG. Co., Towson, Md., manufacturer of portable electric tools, has opened a new sales and service branch at 881 W. Delavan Ave., Buffalo 9, N. Y. The new building covers over 4100 square feet, and increases the sales and service facilities nearly 400 per cent over the company's former location at 17 E. Utica St.

IRA G. SUTTON has been appointed general superintendent of the Sanderson-Halcomb Works of the Crucible Steel Co. of America, Syracuse, N. Y. He was previously assistant general superintendent. Mr. Sutton succeeds R. K. WARREN, who has assumed the post of assistant manager of tool steel sales, with headquarters at Syracuse.

CHESTER F. DELBRIDGE has been appointed general sales manager of the K-G Equipment Co., Inc. (formerly the K-G Welding & Cutting Co., Inc.), New York City, manufacturer of welding and cutting torches. Mr. Delbridge's office is at 50 Broadway, New York 4, N. Y., the executive sales office of the company.

AMERICAN ENGINEERING Co., Philadelphia, Pa., announces the appointment of COMPRESSED AIR PRODUCTS, 400 Third Ave., Brooklyn, N. Y., as exclusive representative for the Hele Shaw and Hydramite pumps manufactured by the company.

MARVIN FRIEDMAN has been appointed production manager and secretary of the Andrel Products Corporation, Brooklyn, N. Y., a company engaged in operating a tool, die, and jig plant. To meet the needs of the present defense program, the concern is producing radar and electronic equipment.

W. G. MILLER has been named manager of manufacturing for the Motor and Control Division of the Westinghouse Electric Corporation at Buffalo, N. Y. He was previously assistant works manager.

A. R. Wise, recently appointed assistant general manager of Cleveland Tapping Machine Co.

Ohio

A. R. WISE, vice-president and sales manager of the Cleveland Tapping Machine Co., subsidiary of Automatic Steel Products, Inc., Canton, Ohio, has been appointed assistant general manager of the company. Mr. Wise has been vice-president of the Cleveland Tapping Machine Co. for the last five years. He was formerly chief engineer and general superintendent of the Spun Steel Corporation, also a division of Automatic Steel Products, Inc.

CYRIL J. BINNE has been made works manager of the Morris Machine Tool Co., Cincinnati, Ohio, manufacturer of radial drilling machines and "Mor-Speed" multiple drilling, tapping, and reaming ma-

Cyril J. Binne, works manager of the Morris Machine Tool Co.

es
ng
ic
o,
al
se
e-
he
ly
n-
a-
ic

le
a-
o,
a-
le
a-

MACHINERY'S DATA SHEETS 677 and 678

AMERICAN STANDARD PLAIN WASHERS—1

Screw and Bolt Sizes		Type Washer															
		Light				Medium				Heavy				Extra Heavy			
Outside Diameter of Thread	Number or Size	Inside Diameter	Outside Diameter	Thickness	Gage	Inside Diameter	Outside Diameter	Thickness	Gage	Inside Diameter	Outside Diameter	Thickness	Gage	Inside Diameter	Outside Diameter	Thickness	Gage
0.060	0	5/64	3/16	0.020	25												
0.073	1	3/32	7/32	0.020	25												
0.086	2	3/32	1/4	0.020	25												
0.099	3	1/8	1/4	0.022	24												
0.112	4	1/8	1/4	0.022	24	1/8	5/16	0.032	21								
0.125	5	5/32	5/16	0.035	20	5/32	3/8	0.049	18								
0.138	6	5/32	5/16	0.035	20	5/32	3/8	0.049	18								
0.151	7	11/64	13/32	0.049	18	3/16	3/8	0.049	18								
0.164	8	3/16	3/8	0.049	18	3/16	7/16	0.049	18								
0.177	9	13/64	15/32	0.049	18	7/32	1/2	0.049	18								
0.187	3/16	7/32	7/16	0.049	18	7/32	1/2	0.049	18	1/4	9/16	0.049	18				
0.190	10	7/32	7/16	0.049	18	1/4	9/16	0.049	18	1/4	9/16	0.065	16				
0.203	11	15/64	17/32	0.049	18	1/4	9/16	0.049	18	1/4	9/16	0.065	16				
0.216	12	1/4	1/2	0.049	18	1/4	9/16	0.049	18	1/4	9/16	0.065	16				
0.242	14	17/64	5/8	0.049	18	5/16	3/4	0.065	16	5/16	7/8	0.065	16				
0.250	1/4	9/32	5/8	0.065	16	5/16	3/4	0.065	16	5/16	3/4	0.065	16	5/16	7/8	0.065	16
0.268	16	9/32	5/8	0.065	16	5/16	3/4	0.065	16	5/16	7/8	0.065	16	5/16	7/8	0.065	16
0.294	18	5/16	3/4	0.065	16	3/8	3/4	0.065	16	3/8	7/8	0.083	14	3/8	1 1/8	0.065	16
0.3125	5/16	11/32	11/16	0.065	16	3/8	3/4	0.065	16	3/8	7/8	0.083	14	3/8	1 1/8	0.065	16
0.320	20	11/32	11/16	0.065	16	3/8	3/4	0.065	16	3/8	7/8	0.083	14	3/8	1 1/8	0.065	16

Note: All dimensions in inches. Tolerances on sizes above heavy line are ± 0.005 inch on inside diameter and ± 0.010 inch on outside diameter. Tolerances on sizes below heavy line are ± 0.010 inch on both diameters.

MACHINERY'S Data Sheet No. 677, March, 1951

Sponsored by the SAE and ASME, and approved as ASA Standard B27.2-1949

AMERICAN STANDARD PLAIN WASHERS—2

Screw and Bolt Sizes		Type Washer															
		Light				Medium				Heavy				Extra Heavy			
Outside Diameter of Thread	Number or Size	Inside Diameter	Outside Diameter	Thickness	Gage	Inside Diameter	Outside Diameter	Thickness	Gage	Inside Diameter	Outside Diameter	Thickness	Gage	Inside Diameter	Outside Diameter	Thickness	Gage
0.372	24	13/32	13/16	0.065	16	7/16	7/8	0.083	14	7/16	1	0.083	14	7/16	1 3/8	0.083	14
0.375	3/8	13/32	13/16	0.065	16	7/16	7/8	0.083	14	7/16	1	0.083	14	7/16	1 3/8	0.083	14
0.4375	7/16	15/32	59/64	0.065	16	1/2	1 1/8	0.083	14	1/2	1 1/4	0.083	14	1/2	1 5/8	0.083	14
0.5000	1/2	17/32	1 1/16	0.095	13	9/16	1 1/4	0.109	12	9/16	1 3/8	0.109	12	9/16	1 7/8	0.109	12
0.5625	9/16	19/32	1 3/16	0.095	13	5/8	1 3/8	0.109	12	5/8	1 1/2	0.109	12	5/8	2 1/8	0.134	10
0.625	5/8	21/32	1 5/16	0.095	13	11/16	1 1/2	0.134	10	11/16	1 3/4	0.134	10	11/16	2 3/8	0.165	8
0.750	3/4	13/16	1 1/2	0.134	10	13/16	1 3/4	0.148	9	13/16	2	0.148	9	13/16	2 7/8	0.165	8
0.875	7/8	15/16	1 3/4	0.134	10	15/16	2	0.165	8	15/16	2 1/4	0.165	8	15/16	3 3/8	0.180	7
1.000	1	1 1/16	2	0.134	10	1 1/16	2 1/4	0.165	8	1 1/16	2 1/2	0.165	8	1 1/16	3 7/8	0.238	4
1.125	1 1/8					1 3/16	2 1/2	0.165	8	1 1/4	2 3/4	0.165	8				
1.250	1 1/4					1 5/16	2 3/4	0.165	8	1 3/8	3	0.165	8				
1.375	1 3/8					1 7/16	3	0.180	7	1 1/2	3 1/4	0.180	7				
1.500	1 1/2					1 9/16	3 1/4	0.180	7	1 5/8	3 1/2	0.180	7				
1.625	1 5/8					1 11/16	3 1/2	0.180	7	1 3/4	3 3/4	0.180	7				
1.750	1 3/4					1 13/16	3 3/4	0.180	7	1 7/8	4	0.180	7				
1.875	1 7/8					1 15/16	4	0.180	7	2	4 1/4	0.180	7				
2.000	2					2 1/16	4 1/4	0.180	7	2 1/8	4 1/2	0.180	7				
2.250	2 1/4									2 3/8	4 3/4	0.220	5				
2.500	2 1/2									2 5/8	5	0.238	4				
2.750	2 3/4									2 7/8	5 1/4	0.259	3				
3.000	3									3 1/8	5 1/2	0.284	2				

Note: All dimensions in inches. Tolerance on both inside and outside diameters is ± 0.010 inch.

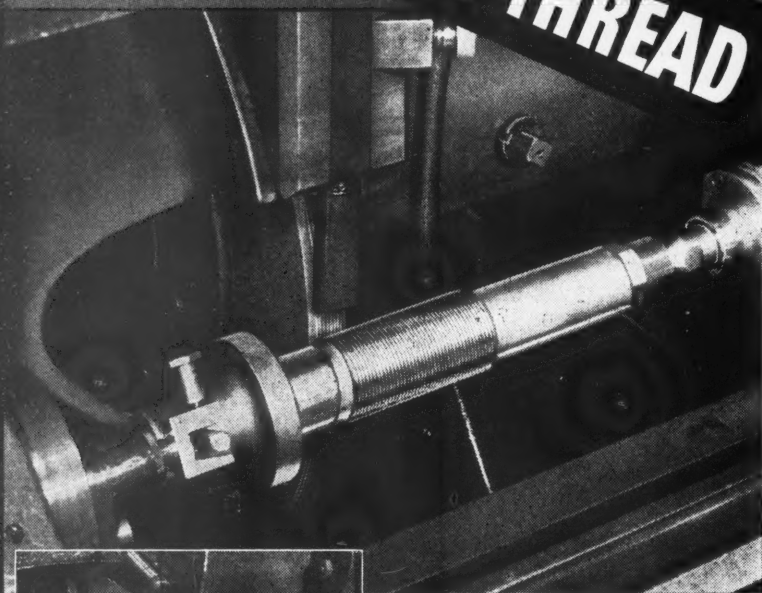
MACHINERY'S Data Sheet No. 678, March, 1951

Sponsored by the SAE and ASME, and approved as ASA Standard B27.2-1949

THE BUSIEST MACHINE IN YOUR SHOP

EX-CELL-O AUTOMATIC THREAD GRINDER

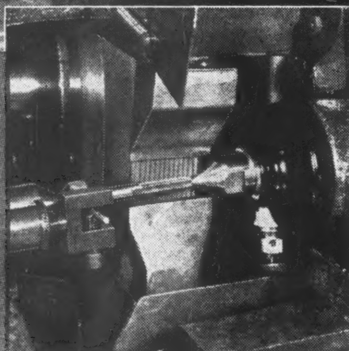
Ex-Cell-O Style 33 Automatic Precision Thread Grinder for external threads. Standard models for internal threads and universal models for both internal and external threads also are made by Ex-Cell-O.



For high production with extraordinary precision, Ex-Cell-O Style 33 Automatic Thread Grinder is a popular choice. It is easy to set up and operate. With equipment for using multi-rib wheels, as shown in the accompanying photographs, output exceeds other methods.

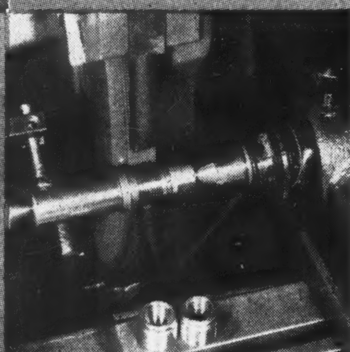
Thread grinding is a must for hardened steel parts. More and more shop supervisors are discovering that grinding is also economical for materials that are tough and abrasive, or soft materials that are inclined to tear under the pressure of cutting tools.

For more information on thread grinding call your Ex-Cell-O representative or write directly to Ex-Cell-O. Please state whether you are interested in internal or external threads or both.

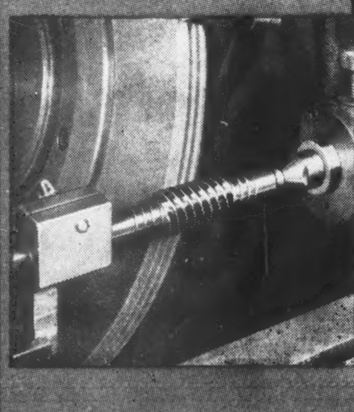


Grinding threads on cast-iron part with diamond dressed multiple-rib wheel on a Style No. 33 Grinder.

Skip-tooth diamond dressed multiple-rib wheel (wheel form is twice pitch of thread) grinding a $\frac{5}{16}$"—18 tap.



Threading stainless steel aircraft bushings on an Ex-Cell-O Style 33 Automatic Thread Grinder.



All three starts of a triple-start worm are ground simultaneously with a triple-rib wheel.

XLO

EX-CELL-O CORPORATION DETROIT 32 MICHIGAN

51-13

MANUFACTURERS OF PRECISION MACHINE TOOLS CUTTING TOOLS • RAILROAD PINS AND BUSHINGS DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

le 33
cision
r for
oads.
s for
s and
ls for
d ex-
so are
ell-O.

ead

ol

ol

der

ou

T 32
GAN

OLS
GS
LA-
NT

chines. For the last four years, he has acted as a field engineer for the company and has directed the development of the Mor-Speed automatic piston balancing machine.

ALBERT J. BOLD has been elected executive vice-president of the newly organized SUPERIOR METAL FABRICATING Co., Niles, Ohio. Prior to his present connection, he was superintendent of the National Gypsum Co.'s plant in Niles. The new company will engage in coil and sheet slitting, job shearing, punch press work, and cold-rolled forming fabrication.

DAVID WHITE, formerly vice-president of the Lester Engineering Co., Cleveland, Ohio, designer of Lester injection molding machines and Lester-Phoenix die-casting machines, has assumed the office of president. DAVID SLOANE has been made vice-president in charge of engineering development.

ROBERT KROGH has been placed in charge of sales in the Cincinnati territory for Ipsen Industries, Inc., of Rockford, Ill., manufacturer of automatic heat-treating units. Mr. Krogh's headquarters are in the Federal Reserve Building, Room 829, Cincinnati, Ohio. He was formerly plant metallurgist.

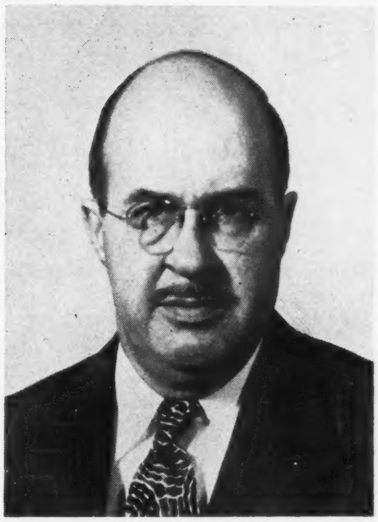
OHIO ELECTRIC MFG. Co., Cleveland, Ohio, announces that it has purchased all tools, patents, and manufacturing rights for the line of drilling machines made by the TAYLOR & FENN Co., Hartford, Conn. The equipment will be manufactured in Cleveland.

ROBERT C. KUHN has been made assistant district manager of the Cleveland sales office of the Crucible Steel Co. of America, New York City. He has been connected with the Cleveland sales department since 1943.

WALTER ZIMMERMANN has been made district manager for the Columbia Tool Steel Co., Cincinnati, Ohio, and will have charge of the tool steel warehouse and office at 2716 Spring Grove Ave. He replaces JAMES TERRY, who has retired.

ALTON F. DAVIS, vice-president and advertising director of the Lincoln Electric Co., Cleveland, Ohio, has been named industrial advertising's "man of the year" for 1950 in an annual competition conducted by *Industrial Marketing*.

BEN KAUL has been made technical development engineer for the Mullins Mfg. Corporation, Salem, Ohio, sheet and strip metal fabricators. He was formerly chief tool and die engineer for the Warren Division of the company, and has served as a technical expert since 1940.



Paul Abel, newly elected vice-president in charge of engineering for the Yoder Co.

PAUL ABEL has been elected vice-president in charge of engineering for the Yoder Co., Cleveland, Ohio, manufacturer of electric tube mills and cold-roll forming, rotary-slitting, and other metal-working machines. Mr. Abel has been with the company since 1934. During the last war, he was superintendent of the gun and navy shell department, and was made chief engineer in 1946.

Wisconsin

GEORGE P. EXTROM has been elected treasurer of the Gisholt Machine Co., Madison, Wis. He has been connected with the company for nearly thirty-five years, and for the last ten years has been assistant secretary.

George P. Extrom, recently elected treasurer of the Gisholt Machine Co.

WILLIAM A. ROBERTS, executive vice-president in charge of the Tractor Division of Allis-Chalmers Mfg. Co., Milwaukee, Wis., since 1947, was elected president at a special meeting of the board of directors to succeed Walter Geist, whose obituary appears in this issue. W. C. JOHNSON, formerly executive vice-president in charge of the General Machinery Division, has been named executive vice-president of the entire company.

TAYLOR DYNAMOMETER & MACHINE Co., manufacturer of "Hi-Eff" precision drilling machines, dynamometers, and balancers, announces its removal to new and larger quarters at 528 W. Highland Ave., Milwaukee, Wis.

A. G. HENDRIKSON has joined the A. C. Smith Corporation, Milwaukee, Wis., as welding equipment sales manager.

Pennsylvania

CARL J. MEISTER has been appointed vice-president and director of sales of the Atlas Chain & Mfg. Co., Philadelphia, Pa. He has been general sales manager of the company since 1943. In addition to serving as vice-president for the Atlas Chain & Mfg. Co., Mr. Meister will also fill the position of director of sales for the Atlas Metal Stamping Co. His headquarters will continue to be in the main plant in Philadelphia.

ALLEGHENY LUDLUM STEEL CORPORATION, Pittsburgh, Pa., announces the following promotions in the sales department: DR. R. A. LINCOLN has been appointed manager of the sales development and engineering service department; C. R. MITCHELL, manager of stainless strip sales; R. S. ROBINSON, manager of carbon steel sales; FRANK F. YOUNG, assistant manager of the Pittsburgh district sales office.

CARPENTER STEEL Co., Reading, Pa., announces plans to erect a $3,000,000 hot-rolling mill in Reading. The new equipment will comprise a combination strip, bar, and rod mill, designed by the Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa., to meet the particular requirements of the company for the production of tool, stainless, and alloy steels.

JOHN C. KOCH has been appointed vice-president in charge of sales for the Conoflow Corporation, Philadelphia, Pa., manufacturer of valves and pneumatic control equipment. Until his recent promotion, Mr. Koch was acting in the capacity of general sales manager.

EDWARD L. MARTIN, for the last eight years technical director of the

(Left) Alex G. McKenna, executive vice-president of Kennametal, Inc. (Right) John C. Redmond, vice-president in charge of metallurgical development

Janney Cylinder Co., Philadelphia, Pa., has resigned to become vice-president in charge of technical development for Charles J. Haas, Inc., American and Cumberland Sts., Philadelphia 33, Pa., manufacturer of industrial chemicals, oils, and greases.

CLARENCE LYNN has been made engineering manager of the Atomic Power Division of the Westinghouse Electric Corporation, Pittsburgh, Pa. Mr. Lynn has spent his entire business career with the Westinghouse organization, joining the company in 1919 as a graduate student. Prior to his present appointment, he was manager of the direct-current engineering department of the Transportation and Generator Division at the East Pittsburgh plant.

Clarence Lynn, recently appointed engineering manager of the Westinghouse Atomic Power Division

ALEX G. MCKENNA has been made executive vice-president of Kennametal, Inc., Latrobe, Pa.; JOHN C. REDMOND, formerly research director, has been elected vice-president in charge of metallurgical development; and RICHARD J. FLICKINGER becomes assistant secretary. Among the appointments announced in the sales department are: BENNETT BURGOON, JR., assistant to the general sales manager; GILBERT BUNN, manager of the Detroit-Cleveland district, succeeding Mr. Burgoon; and DOUGLAS C. CUNNINGHAM, manager of the Philadelphia-New York district, replacing Mr. Bunn.

BIRDSBORO STEEL FOUNDRY & MACHINE Co., Birdsboro, Pa., announces the appointment of the following new officers: ROBERT F. RENTSCHLER, vice-president assigned to special duties; JAMES M. HEPPENSTALL, treasurer; and LESTER E. LEINBACH, secretary.

ACME STEEL Co., Pittsburgh, Pa., has been licensed by the United States Steel Co. to manufacture "Cor-Ten," a corrosion-resistant, high-strength, low-alloy steel developed by Carnegie-Illinois Steel Corporation.

LUDWIG W. RITSCHEL has been made representative in the Philadelphia territory for the Billings & Spencer Co., Hartford, Conn., manufacturer of wrenches and other shop tools.

JOHN H. ELLIOTT has been made general manager of manufacturing, and WILLIAM C. OBERG manufacturing consultant of the United States Steel Co., Pittsburgh, Pa.

E. R. WALSH, III, has been appointed general sales manager of the Alloy Rods Co., York, Pa. For several years he served as district sales manager.

Coming Events

MARCH 15-17—Annual meeting of the American Society of Tool Engineers at the Hotel New Yorker in New York City. Executive secretary, Harry E. Conrad, 10700 Puritan Ave., Detroit 21, Mich.

MARCH 19-23 — Seventh WESTERN METAL EXPOSITION AND CONGRESS in the Auditorium and Exposition Hall in Oakland, Calif. Sponsored by the American Society for Metals, in co-operation with twenty other national technical societies. Secretary, William H. Eisenman, Exposition Hall, 918 Fallon St., Oakland 7, Calif.

MARCH 19-23—CONFERENCE ON INDUSTRIAL PERSONNEL at Columbia University, New York City. Further information and registration procedure can be obtained by addressing David N. Edwards, Instructor in Industrial Engineering, Columbia University, New York 27, N. Y.

APRIL 16-18—National convention of the AMERICAN SOCIETY OF LUBRICATION ENGINEERS at the Bellevue-Stratford Hotel in Philadelphia, Pa. National secretary, W. F. Leonard, 343 S. Dearborn St., Chicago 4, Ill.

APRIL 17-20—TWENTIETH NATIONAL PACKAGING EXPOSITION sponsored by the AMERICAN MANAGEMENT ASSOCIATION at the Auditorium in Atlantic City, N. J. Public relations director, Edward K. Moss, 330 W. 42nd St., New York 18, N. Y.

APRIL 19-20—Sixth annual TIME STUDY and METHODS CONFERENCE at the Hotel Statler, New York City. Sponsored by the Society for Advancement of Management, 84 William St., New York 38, N. Y., and the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.

APRIL 23-26—Fifty-fifth annual convention of AMERICAN FOUNDRYMEN'S SOCIETY in Buffalo, N. Y. Secretary-treasurer, William W. Maloney, 616 S. Michigan Ave., Chicago 5, Ill.

APRIL 30-MAY 4—FOURTH NATIONAL MATERIALS - HANDLING EXPOSITION in the International Amphitheatre, Chicago, Ill. Sponsored by the Materials Handling Institute. Further information can be obtained from the exposition management, Clapp & Poliak, Inc., 341 Madison Ave., New York 17.

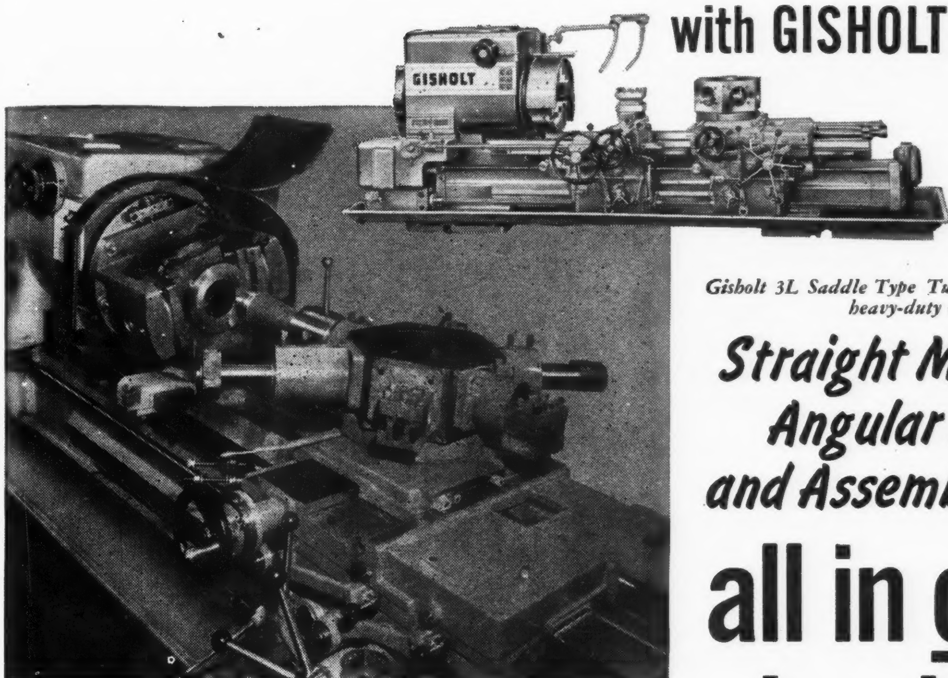
APRIL 30-MAY 11—BRITISH INDUSTRIES FAIR in Birmingham and London, England. Further information can be obtained from British Information Services, 30 Rockefeller Plaza, New York 20, N. Y.

(Continued on page 250)

Nice work if you can do it...

and you can...

with GISHOLT Turret Lathes...



Gisholt 3L Saddle Type Turret Lathe—one of five sizes for heavy-duty work of all kinds

Straight Machining... Angular Machining and Assembly...

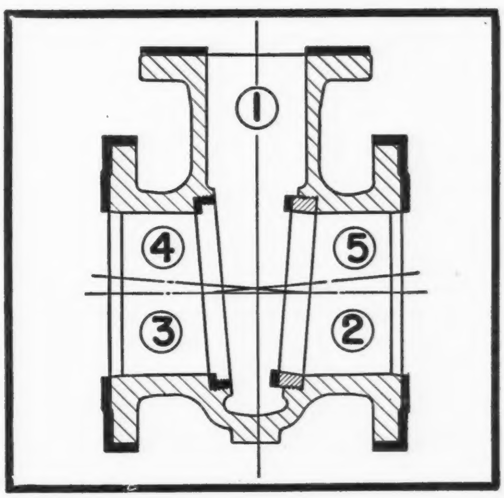
all in one chucking!

Talk about time-cutting ideas, here's the versatility of a Gisholt 3L Saddle Type Turret Lathe paying off again.

All operations required to machine these gate valve bodies are done in a single chucking with a five-position indexing fixture. In addition to machining the bonnet and the two ends, the recesses for the two seat rings are bored and threaded at a five degree angle.

Then the seat rings are inserted—and tightly screwed in place with a driver mounted on the turret. The driving is done with a constant torque—adjustable to suit each job. The final operation is finish facing the seat ring after it is in place with the cross-feeding turret.

Gisholt Engineers have storehouses of ideas to help you increase your production. Ask one to call.



GISHOLT MACHINE COMPANY
Madison 10, Wisconsin

THE GISHOLT ROUND TABLE
represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

MAY 23-24—Fifth annual convention of the AMERICAN SOCIETY FOR QUALITY CONTROL in Cleveland, Ohio; headquarters, Hotel Cleveland. For further information, address John F. Occasione, Publicity Chairman, American Society for Quality Control, care of American Steel & Wire Co., 1406 Rockefeller Bldg., Cleveland 13, Ohio.

JUNE 3-8—Summer meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the French Lick Springs Hotel, French Lick, Ind.

JUNE 11 to 15—Second annual CONFERENCE ON INDUSTRIAL RESEARCH at Columbia University in New York City. Director, David B. Hertz, assistant professor of industrial engineering, Columbia University, New York 27, N. Y.

JUNE 11-16—FIRST NATIONAL CONGRESS OF APPLIED MECHANICS in Chicago, Ill., under the sponsorship of the Illinois Institute of Technology, Chicago 16, Ill., and three other universities, as well as nine professional societies. Director of public relations, James W. Armsey, Illinois Institute of Technology, Chicago 16, Ill.

JUNE 18-22—Annual meeting of the AMERICAN SOCIETY FOR TESTING MATERIALS at Atlantic City, N. J.; headquarters, Chalfonte-Haddon Hall Hotel. Secretary, C. L. Warwick, 1916 Race St., Philadelphia 3, Pa.

OCTOBER 15-19—THIRTY-THIRD ANNUAL METAL SHOW and NATIONAL METAL CONGRESS at Detroit, Mich. Sponsored by the American Society for Metals; American Welding Society; Metals Branch, American Institute of Mining and Metallurgical Engineers; and Society for Non-Destructive Testing. Further information can be obtained from W. H. Eisenman, managing director, American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio.

Obituaries

Robert C. Stanley

Robert Crooks Stanley, chairman of the board of directors of the International Nickel Co. of Canada, Ltd., died on February 12 at his home in Dongan Hills, Staten Island, N. Y., at the age of seventy-four. Mr. Stanley had been connected with the metallurgical industry since 1901, and was credited with several important inventions in that field.

He was born in Little Falls, N. J., on August 1, 1876. In 1899, he received a mechanical engineering degree from Stevens Institute of Technology, and in 1901 was awarded the degree of mining engineer by the Columbia School of Mines. Later he was the recipient of the honorary degrees of doctor of engineering, doctor of science, and doctor of laws from various universities. Following his graduation from Columbia, he joined the S. S. White Dental Co. of Philadelphia for whom he investigated platinum sands in British Columbia.

Mr. Stanley became connected with the International Nickel Co. in 1902 as assistant superintendent of the Camden plant, and rose steadily from that position. He was elected a director of the company in 1917, and the next year was made vice-president in charge of all operations. In 1922, he became president, which position he held until 1950. Mr. Stanley was the discoverer of Monel metal, an alloy of nickel and copper which has become one of the outstanding alloys used by industry.

Walter Geist

Walter Geist, president of the Allis-Chalmers Mfg. Co., Milwaukee, Wis., died suddenly on January 29 of a heart ailment at the age of fifty-six years. Mr. Geist was born in Milwaukee, Wis., and received his education in the public schools of that city. He left high school in 1909 to join the Allis-Chalmers organization, but continued his studies by taking evening and extension courses at the University of Wisconsin. Starting as a messenger boy in the blueprint department, with a wage of 10 cents per hour, he was advanced in a short time to the position of tracer in the milling department, from which he worked upward through the posts of draftsman and engineer until he was named assistant manager in 1928.

It was while he was an engineer in charge of transmission in the milling department that he developed the multiple V-belt Texrope drive, for which he was awarded the plaque of the "Modern Pioneer" by a group of distinguished scientists headed by the president of the Massachusetts Institute of Technology. Following this development, he moved into the company's sales organization and traveled around the country explaining and selling the V-belt drive.

In 1933, Mr. Geist was named general sales representative for the General Machinery Division. His next promotion came in 1939, when he was elected a vice-president in that division. Three years later, he was selected as executive vice-president, and in the same year was elected president. Mr. Geist was a director of many business enterprises.

Edward J. Helline

Edward Joseph Helline, general sales manager of the Reliance Division of the Eaton Mfg. Co., Massillon, Ohio, died on February 8 in the Massillon City Hospital, aged forty-eight years. Mr. Helline became associated with the Eaton Mfg. Co. thirty-two years ago as a mail clerk, and advanced steadily through the advertising and sales departments to the position of general sales manager of the Reliance Division, which he had held since June 1, 1947. Mr. Helline served as chairman of the Standards Committee of the Spring Washer Institute.

Edward L. Holljes

Edward Louis Holljes, general sales manager of the William Sellers Co. Division, Consolidated Machine Tool Corporation, Rochester, N. Y., died on February 3. He was born in Baltimore, Md., on May 29, 1884, and received his education at John Hopkins and Lehigh University.

In 1905, he went to work as a special apprentice at the Baldwin Locomotive Works, and in 1908 joined William Sellers & Co. as a machine tool salesman. Mr. Holljes was made sales manager of the company in 1927, and became general sales manager in 1942. When William Sellers & Co. was merged with the Consolidated Machine Tool Corporation in 1947, Mr. Holljes was appointed general sales manager of the William Sellers Co. Division.

W. L. Iliff

W. L. Iliff, manager of eastern sales, Hyatt Bearings Division, General Motors Corporation, Harrison, N. J., died on February 3 at the age of sixty. Mr. Iliff had been with the Hyatt organization since 1914, shortly after graduating from Stevens Institute of Technology.